

A TAXONOMIC SURVEY OF THE AGROMYZIDAE (DIPTERA) OF ALBERTA,
CANADA, WITH OBSERVATIONS ON HOST-PLANT RELATIONSHIPS

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Thirty-one new species are described and eleven further are recorded from Alberta for the first time. This brings the total of Albertan Agromyzidae to 170 and that for Canada and Alaska to 321 species. Genitalia of all males representing new species are illustrated. Keys to Albertan genera and species, diagnostic characters and data on larval host-plants are given. Host-plant relationships are discussed.

In der vorliegenden Arbeit einunddreißig neu Agromyzid Arten sind beschrieben und weitere elf von Alberta sind zum erstmalig aufgeführt. Das bringt die gesamte Zahl von Alberta auf 170 und diese von Kanada und Alaska auf 321 Arten. Die männliche Genitalia alle neue Arten sind abgebildet. Die Bestimmungsschlüssel für die Gattungen und Arten von Alberta, ihre Bezeichnungen den Merkmale und Einzelhalten über Raupenfutter sind angegeben. Die Angaben zur Bionomie sind besprochen.

This survey of the family Agromyzidae in Alberta was started in the summer of 1966, when this was one of the most poorly known families of cyclorrhaphous Diptera in Canada. Strickland (1938, 1946) listed 20 species as occurring in Alberta. The only comprehensive treatment for North American Agromyzidae was by Frick (1959) who included those known from Canada. Since the publication of Frick's synopsis, the concept of certain genera of Agromyzidae has been revised by Nowakowski (1962) on the basis of his studies of male genitalia. As new characters of male genitalia were discovered, it became necessary to confirm all determinations of species, which were previously based on external morphology and sometimes only on female specimens. One of my main objectives was to collect, determine, and describe as many species as possible in order to assess the family Agromyzidae in Alberta and in Canada, and to provide keys for the determination of genera and species. This investigation in Alberta was started parallel to Spencer's 1969 synopsis of the Agromyzidae of Canada and Alaska. As a preliminary report on these investigations I described 13 new species from Alberta (Sehgal, 1968). Spencer examined all previously known records of Canadian and Alaskan Agromyzidae and confirmed a total of 290 species.

Among the Canadian species Spencer (1969) recorded 128 described species as occurring in Alberta. As a result of this study 31 new species are described from Alberta and 11 further species have been recorded for the first time as occurring in Alberta. This brings the total of Albertan Agromyzidae to 170 and that of Canadian and Alaskan Agromyzidae to 321 described species (Table 1). The male genitalia of almost all Albertan species have been examined. Any record of Albertan Agromyzidae outside the present work must be considered tentative, until confirmed on the basis of male genitalia.

Table 1. Distribution among genera of new species, new Alberta records, and all known species of Agromyzidae from Alberta, and Canada and Alaska.

Genus	New species	New Alberta records	Total number of species now known from:	
			Alberta	Canada and Alaska
<i>Agromyza</i>	2	2	17	36
<i>Melanagromyza</i>	3	—	9	20
<i>Hexomyza</i>	—	—	1	2
<i>Ophiomyia</i>	1	—	17	27
<i>Phytobia</i>	—	1	3	8
<i>Cerodontha</i>				
<i>Dizygomyza</i>	—	2	7	18
<i>Poemyza</i>	—	—	5	8
<i>Icteromyza</i>	—	—	2	6
<i>Cerodontha</i>	—	—	2	3
<i>Calycomyza</i>	—	1	2	13
<i>Amauromyza</i>	2	—	2	5
<i>Nemorimyza</i>	—	—	1	1
<i>Liriomyza</i>	6	1	27	42
<i>Lemurimyza</i>	—	—	1	3
<i>Metopomyza</i>	1	—	2	4
<i>Praspedomyza</i>	—	—	1	1
<i>Haplomyza</i>	—	—	1	1
<i>Phytoliriomyza</i>	—	—	1	2
<i>Paraphytomyza</i>	1	—	5	7
<i>Pseudonapomyza</i>	—	—	2	2
<i>Napomyza</i>	—	—	3	9
<i>Phytomyza</i>	15	4	59	98
Other genera	—	—	—	5
TOTAL	31	11	170	321

MATERIALS AND METHODS

As a part of this study I made intensive collections of agromyzid specimens from the province of Alberta, Canada, including the Alberta Rockies. Some specimens collected by others, especially G. C. D. Griffiths, K. A. Spencer, the late Professor E. H. Strickland, and B. Hocking, from Alberta localities were also examined and are acknowledged in the list of material.

Attempts were made to rear adults from immature stages as far as possible. This permitted me to clarify the biology of many species. I studied approximately 1200 specimens and examined genitalia preparations of 620 specimens. Genitalia of all males representing new species and a few other species where necessary for their specific determination have been illustrated. Reference is made to good earlier illustrations of male genitalia. The holotypes and allotypes of all new species will be deposited in the Canadian National Collection, Ottawa.

The terminology used in describing new species is that employed by Spencer (1969) and other workers in Agromyzidae. The frons width and eye width are measured at the level of the median front ocellus from above. The term gena here means the area below the eyes including the lower orbits. The ratio of genal and eye heights are measured mid-way between vibrissal and posterior margins. The terminology of the aedeagus is that used by Frick (1952) and Spencer (1969).

Abbreviations

acr, arcostichal hair; Adap, aedeagal apodeme; Ar, arista; As3, third antennal article; Bsph, basiphallus; C, costa; dc, dorsocentral bristles; Dph, distiphallus; Ejap, ejaculatory apodeme; Ejb, ejaculatory bulb; Ejd, ejaculatory duct; Hypa, hypandrium; m-m, medial crossvein; M_{1+2} and M_{3+4} , median veins; Mph, mesophallus; oc, ocellar bristles; Ori, lower orbital bristles; Ors, upper orbital bristles; os, orbital setulae; Pgo, postgonites; Phph, phallophore; Prgo, pregonites; Pvt, postvertical bristles; R_1 , R_{2+3} and R_{4+5} , radial veins; r-m, radiomedial crossvein; Sc, subcosta; Vi, Vibrissa; Vte, outer vertical bristle; Vti, inner vertical bristle.

CHARACTERISTICS OF THE FAMILY AGROMYZIDAE

The main distinguishing characters of the members of this family are as follows:

Head. — Postvertical bristles divergent; distinct orbital bristles present, normally two strong upper orbital bristles, Ors, directed upwards and two lower orbital bristles, Ori, directed inwards and upwards; orbital setulae present; distinct vibrissal hair present, represented by a bunch of fused hairs or 'vibrissal horn' in some males of the genus *Ophiomyia* Braschnikov; centre of frons without bristles or setulae.

Mesonotum. — Distinct dorsocentral bristles present, normally 3+1, sometimes a few anterior bristles are reduced or lost; variable number of acrostichals present; scutellum normally with four scutellar bristles, two in subgenus *Cerodontha* Rondani.

Wing. — Costa broken at end of subcosta, extended to apex of vein R_{4+5} or M_{1+2} ; subcosta weakly developed distally, adjacent to, and either joined to or independent from R_1 distally; crossvein r-m present; anal vein shortened, not extended to the wing margin.

Male genitalia. — Hypandrium large and well developed; pregonites and postgonites normally well differentiated, former sometimes fused with hypandrium; epandrium large and conspicuous; surstyli and cerci normally well developed and with characteristic setae or setulae; aedeagus complex; aedeagal apodeme large and darkly sclerotized; aedeagal hood conspicuous; aedeagus with distinct basal section consisting of basiphallus and phallophore and distal section consisting of various sclerites forming mesophallus, paraphallus, and distiphallus; terminal section of ejaculatory duct inside distiphallus normally bifid; ejaculatory apodeme normally well developed, sometimes reduced, bulb conspicuous.

Female postabdomen. — Seventh segment completely sclerotized, forming a conical ovipositor sheath; eighth segment elongate, retractible into seventh, bearing numerous anteriorly directed denticles; pair of egg guides around gonopore; anus well beyond gonopore; two spermathecae.

Larvae. — Anterior spiracles on first abdominal segment approximate; posterior spiracles on last or eighth abdominal segment approximate or widely separated; mouth hooks well developed and almost vertical in relation to labial sclerite; paraclypeal phragma normally with dorsal and ventral arms; muscle scars and tubercle bands strongly developed along lateral portions of abdominal segments.

Biology. — Larvae feed inside the living tissue of angiosperms (except those of *Pteridomyza* Nowakowski, *Liriomyza felti* (Mall.) and *Phytomyza scolopenderii* R.-D. which feed on ferns and few representatives of the genus *Liriomyza* Mik feeding on horsetails and liverworts). Larvae show varying host-plant specificity, but normally feed on one plant organ. Most species feed as leaf miners, some feed inside the stems, seeds, and other parts of plants; a few cause galls (*Hexomyza* Enderlein).

TAXONOMIC TREATMENT

The generic concept used in this study is the one which has come to be generally accepted (Spencer, 1969), but is certainly not final in agromyzid classification. As recent studies progress on the male genitalia, the need for defining some of the larger genera on a monophyletic basis becomes more apparent. No attempt is made in this study to undertake any generic revision of the existing classification.

According to the biological species concept (Mayr, 1963), species are defined to be groups of actually or potentially interbreeding natural populations, which are reproductively isolated from other such groups. I accept this species definition. The application of this species concept presents many practical difficulties and some of these have been discussed by Mayr (1969). The reproductive isolation of a population is usually inferred indirectly from comparisons of external morphology. In Agromyzidae, besides the evidence of external morphology, various other evidences are helpful. The majority of agromyzid species are restricted feeders, either monophagous or oligophagous, confined to botanically related plant species. It seems highly unlikely that significant gene interchange occurs between populations restricted to unrelated host-plants, even if the morphological differences between them are minor. Such populations can be assumed to represent distinct species, so long as the observed differences are shown consistently. Often other evidence such as larval morphology or shape of mine is available to support this assumption.

Spencer (1969) discussed briefly the significance of various taxonomic characters currently in use in agromyzid taxonomy; the same criteria have been accepted here. The characters of male genitalia have been used as far as possible in order to provide a basis for more accurate determination of species. Information on Albertan host-plants and biology, wherever available, has been included. The following key represents a further development of that originally produced by Hendel (1931) and modified by Frick (1952, 1959) and Spencer (1969).

Key to genera of Albertan Agromyzidae

- | | | |
|-------|--|--|
| 1(0). | Subcosta developed throughout its length, coalesced with R_1 before contact with costa | 2 |
| - | Subcosta weakly developed distally, joined with costa independent of R_1 | 5 |
| 2(1). | Prescutellars absent; dorsocentrals, two, three or four pairs, if three or four pairs halteres black | 3 |
| - | Prescutellars present; at least three pairs of dorsocentrals; halteres yellow | <i>Agromyza</i> Failén, p.296 |
| 3(2). | Mesonotum or abdomen normally with greenish, bluish or coppery metallic sheen; antennae not separated by conspicuous keel; aedeagus with basiphallus U-shaped; larvae normally with conspicuous horn in centre of posterior spiracles; larvae feed inside stems or seeds | <i>Melanagromyza</i> Hendel, p.303 |
| - | Mesonotum and abdomen black; aedeagus with basiphallus with long side arms; posterior spiracles of larva without central horn | 4 |

- 4(3). Antennae separated by conspicuous raised facial keel (absent from *pulicaria* group); male with or without distinct vibrissal horn; larval posterior spiracles with more than three bulbs; larva feeds below stem epidermis or as leaf miner
 *Ophiomyia* Braschnikov, p. 310
- Antennae approximate; male without vibrissal horn; larval posterior spiracles with three bulbs; larva gall producer *Hexomyza* Enderlein, p. 309
- 5(1). Orbital setulae erect or reclinate, rarely absent. 6
- Orbital setulae distinctly proclinate 18
- 6(5). Costa extended to apex of vein M_{1+2} , if only to R_{4+5} then either crossvein m-m absent (*Phytobia confessa* Spencer) or lunule broad, distinctly higher than semicircle (*Cerodontha (Dizygomyza) frankensis* Spencer) 7
- Costa extended to apex of vein R_{4+5} 17
- 7(6). Scutellum normally dark, concolourous with mesonotum 8
- Scutellum yellow; vein M_{1+2} ending nearest wing tip 14
- 8(7). Halteres with knob white or yellow 9
- Halteres with knob black or partially darkened, if yellow distiphallus with numerous spinules *Amauromyza* Hendel, p. 326
- 9(8). Crossvein m-m absent *Haplomyza* Hendel, p. 344
- Crossvein m-m present 10
- 10(9). Vein R_{4+5} ending nearest wing tip; larvae cambium miners
 *Phytobia* Lioy, p. 316
- Vein M_{1+2} ending nearest wing tip 11
- 11(10). Third antennal article with conspicuous spine anterodorsally, scutellum with only two bristles; or lunule higher than semicircle, narrow or triangular; or lunule broad, antennal bases widely separated, third antennal article in male distinctly enlarged *Cerodontha* Rondani, p. 317
- Not so 12
- 12(11). Fore-tibia with lateral bristle; abdomen in male yellowish; larva makes characteristic blotch mine with concentric rings on *Aster* and *Solidago* in *Nemorimyza posticata* (Meigen) *Nemorimyza* Frey, p. 327
- Fore-tibia without lateral bristle; leaf mine not as above 13
- 13(12). Frons dark; orbits raised above plane of frons *Praspedomyza* Hendel, p. 343
- Frons yellow, orbits in same plane as frons *Calycomyza* Hendel, p. 325
- 14(7). Frons yellow; orbits in plane of frons 15
- Frons dark; orbits raised above plane of frons *Metopomyza* Hendel, p. 342
- 15(14). Crossvein m-m absent; one Ors. *Haplomyza* Hendel, p. 344
- Crossvein m-m present (absent in *Liriomyza singula* Spencer); two Ors 16
- 16(15). Prescutellar area yellow; orbital setulae normally erect; aedeagus with sclerotized paired tubules in the distiphallus, epandrium with conspicuous black spines
 *Lemurimyza* Spencer, p. 341
- Prescutellar area normally dark, sometimes yellow; orbital setulae reclinate; aedeagus variable in form, but not as in the genus *Lemurimyza* Spencer
 *Liriomyza* Mik, p. 328
- 17(6). Crossvein m-m either absent, or if present well beyond r-m
 *Paraphytomyza* Enderlein, p. 345
- Crossvein m-m basal to r-m *Pseudonapomyza* Hendel, p. 345
- 18(5). Crossvein m-m basal to or at same level as r-m *Napomyza* Westwood, p. 349
- Crossvein m-m absent *Phytomyza* Fallén, p. 350

Genus *Agromyza* Fallén

Agromyza Fallén 1810:21.

The main distinguishing characters of this genus are subcosta developed throughout its length and coalesced with R_1 before contact with costa; at least three pairs of dorsocentrals; prescutellars present and halteres yellow.

This genus is represented in Alberta by 17 species, of which two are described as new. The species in this genus form a very diverse assemblage of many groups. The species in the *ambigua* group, *albertensis* Sehgal, *aprilina* Malloch and *kincaidi* Malloch; as well as species in the *nigripes* group, *albipennis* Malloch, *brevispinata* new species, *hockingi* Spencer and *nigripes* Meigen; like other members of the *ambigua/nigripes* groups (Griffiths, 1963) form a single group of grass mining species with similarity in shape of the distiphallus. Members of the *ambigua* group differ from those of the *nigripes* group only by a shortened costa, not extended beyond the apex of vein R_{4+5} , and longer distiphallus. The *Urtica* miner, *pseudoreptans* Nowakowski, belongs to the *reptans* group, while the *Mertensia* miner, *canadensis* Malloch, belongs to the *rufipes* group.

The species in the *spiraeae* group, *populoides* Spencer, *vockerothi* Spencer, *fragariae* Malloch, *masculina* Sehgal and *spiraeae* Kaltenbach, are believed to be closely related due to similarities in the male genitalia. This concept was first proposed by Sasakawa (1961). The species in this group have asymmetric sclerotization of the basiphallus and mesophallus.

A. aristata Malloch, whose larvae mine the leaves of *Ulmus americana* L., family Ulmaceae, is probably close to the *rubi/spiraeae* group of Sasakawa (1961). Another group of species whose members are characterized by 3+1 strong dorsocentrals and yellow frons is represented in Alberta by *nearctica* new species. Three further females belonging to this group cannot be identified in the absence of males. The leaf mines on members of *Geum allepicum* Jacq., *Potentilla* sp., and *Rosa acicularis* Lindl., of the family Rosaceae probably represent those of the members of the *spiraeae* group, but no flies have been bred from these hosts.

Key to Alberta species of the genus *Agromyza* Fallén

- | | | |
|-------|--|----------------------------------|
| 1(0). | Dorsocentrals 3-6, decreased significantly in size anteriorly; presuturals as well as anterior postsutural dorsocentrals usually not distinguishable from acrostichals | 2 |
| - | Dorsocentrals 3+1, strong and distinct | 12 |
| 2(1). | Wing tip near apex of vein M_{1+2} | <i>sulfuriceps</i> Strobl, p.303 |
| - | Wing tip near apex of vein R_{4+5} or midway between R_{4+5} and M_{1+2} | 3 |
| 3(2). | Legs largely yellowish | 4 |
| - | Legs largely black or brown | 5 |
| 4(3). | Antennae yellow, smaller specimens, wing length 2.2 to 2.7 mm; larvae leaf miner on <i>Ulmus americana</i> L. | <i>aristata</i> Malloch, p.298 |
| - | Antennae dark brown; larger specimens, wing length about 3.0 mm | <i>canadensis</i> Malloch, p.299 |
| 5(3). | Costa extended to apex of vein R_{4+5} | 6 |
| - | Costa extended to apex of vein M_{1+2} | 8 |
| 6(5). | Squamal fringe brown or black; larger specimens, wing length about 2.7 to 3.5 mm | <i>kincaidi</i> Malloch, p.300 |
| - | Squamal fringe pale or whitish, smaller specimens | 7 |
| 7(6). | Third antennal article with distinct angle or point anterodorsally; eyes upright, normal | <i>albertensis</i> Sehgal, p.297 |

- Third antennal article rounded at end; eye distinctly slanted *aprilina* Malloch, p. 298
- 8(5). Mesonotum at least weakly shining black; mesophallus and distiphallus single S-shaped sclerotization. 9
- Mesonotum distinctly mat black; mesophallus and distiphallus separate sclerotizations *pseudoreptans* Nowakowski, p. 302
- 9(8). Third antennal article with distinct angle anterodorsally 10
- Third antennal article rounded at tip 11
- 10(9). Squamal fringe pale or whitish; ejaculatory bulb very broad *albipennis* Meigen, p. 297
- Squamal fringe dark or brown; ejaculatory bulb narrower *nigripes* Meigen, p. 302
- 11(9). Surstyli with 3-6 distinctly large spines (Fig. 6) *hockingi* Spencer, p. 300
- Surstyli with smaller spines (Fig. 5); aedeagus as in Fig. 3, 4 *brevispinata* n. sp., p. 298
- 12(1). Frons reddish yellow; orbits black; second and third antennal articles black; aedeagus as in Fig. 10 *nearctica* n. sp., p. 301
- Frons dark, brown or black 13
- 13(12). Squamal fringe pale *populoides* Spencer, p. 302
- Squamal fringe darker, brown or black. 14
- 14(13). Mid-tibia with a strong bristle posteriorly. *vockerothi* Spencer, p. 303
- Mid-tibia without a distinct bristle 15
- 15(14). Frons distinctly brown. *fragariae* Malloch, p. 300
- Frons distinctly mat black 16
- 16(15). Gena narrow one-eighth to one-tenth eye height; basiphallus and mesophallus with sclerotized strips *masculina* Sehgal, p. 301
- Gena broader, about one-fifth eye height; distiphallus separated from basiphallus by long membranous section *spiraeae* Kaltentbach, p. 302

Agromyza albertensis Sehgal

Agromyza albertensis Sehgal 1968:57; Spencer, 1969:32.

Comparisons and diagnostic characters. — The members of this species differ from those of a similar species, *kincaidi* Malloch, in smaller size, wing length 2.0-2.7 mm and in having pale squamal fringe, and from those of *ambigua* Fallén in having frons less projected above eyes in profile. The main distinguishing characters are the conspicuous angle on the third antennal article and distinct male genitalia. Sehgal (1968) illustrated the head, wing and male genitalia characteristic of this species. Spencer (1969) also figured the aedeagus.

Biology. — Not confirmed, but larvae probably mine leaves of grasses (Gramineae).

Geographical distribution. — Known only from Alberta, from the following localities: CANADA. Alberta: Banff, Blairmore, Elkwater.

Agromyza albipennis Meigen

Agromyza albipennis Meigen 1830:171; Spencer, 1969:32.

Diagnostic characters. — The members of this species may be recognised by the combination of characters given in the key. The distinctive aedeagus and ejaculatory bulb are as illustrated (Fig. 1, 2). Sasakawa (1961) and Griffiths (1963) described in detail and illustrated significant diagnostic characteristics of this species.

Biology. — Larvae are known to mine the leaves of grasses (Gramineae) (Sasakawa, 1961; Griffiths, 1963).

Geographical distribution. — The members of this species are Holarctic in distribution, known from numerous localities in Europe (Griffiths, 1963), Japan (Sasakawa, 1961) and Canada (Spencer, 1969). I have examined three specimens from the following localities:

CANADA. Alberta: 1 ♀ Cypress Hills, near Elkwater Lake, 24.vi.1966; 1 ♂ Devon, University of Alberta botanical garden, 22.vi.1966; 1 ♂ Edmonton, Rainbow Valley, 14.vi.1968.

Agromyza aprilina Malloch

Agromyza aprilina Malloch 1915b:359; Spencer, 1969:36.

Comparison and diagnostic characters. — The members of this species resemble closely those of *A. kincaidi* Malloch and can be reliably separated only by examination of the characters of male genitalia. Other external differences are pale squamal fringe, smaller size and distinctly slanting eyes. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Not confirmed, but the larvae probably mine the leaves of grasses (Gramineae).

Geographical distribution. — The members of this species are Nearctic in distribution and are known from United States and Canada. The known Alberta locality is:

CANADA. Alberta: Banff (Spencer, 1969).

Agromyza aristata Malloch

Agromyza aristata Malloch 1915a: 13; Spencer, 1969:38.

Agromyza ulmi Frost 1924:54; Frick, 1957:199.

Diagnostic characters. — The members of this species may be recognized by the combination of characters given in the key. Spencer (1969) illustrated the distinctive aedeagus.

Biology. — Larvae make elongated blotch mines on the upper surface of the leaves of *Ulmus americana* L., family Ulmaceae. The leaf mines appear in great numbers around Edmonton during the second week of June. The members of this species have only one generation a year in Alberta.

Geographical distribution. — The members of this species are widespread in United States (Frick, 1959) and are also known from Canada (Spencer, 1969). I have examined the following material from Alberta:

CANADA. Alberta: 2 ♀♀ Edmonton, University of Alberta campus from leaf mines on *Ulmus americana* L., coll. 6.vi.1968, emerged 2-27.v.1969, coll. G. C. D. Griffiths; 1 ♀ same locality, swept over same host, 3.vi.1969; Numerous leaf mines on *Ulmus americana* L., same locality, 9.vi.1966, 5.vi.1967, 10.vi.1968.

Agromyza brevispinata new species

Comparison and diagnostic characters. — The male of this species differs from those of the similar species *hockingi* Spencer and *lucida* Hendel in having a weakly shining or somewhat mat mesonotum and distinct male genitalia. This species is included in Spencer's (1969) key to Canadian species of the genus *Agromyza* Fallén by amending and extending the couplet as follows:

26. Third antennal segment distinctly cut away below (Spencer, 1969, Fig. 5)
 *nigripes* Meigen

- Third antennal segment rounded at tip. 26a
 26a. Mesonotum somewhat mat or weakly shining black; surstyli with 8-10 small spines; aedeagus as in Fig. 3, 4 *brevispinata* n.sp.
 - Mesonotum entirely shining black 27

Description. — Head. Frons slightly wider than width of eye at level of front ocellus, not projected in front of eye margin in profile; two strong Ors directed upwards; two Ori directed inwards and upwards; orbital setulae reclinate; eyes oval, approximately 1.3 times higher than their length; gena deepest at rear, approximately one-fifth eye height midway between vibrissal and posterior margins; third antennal article rounded at tip; arista long and pubescent.

Mesonotum. Two strong dorsocentrals; acr in about nine irregular rows.

Wing. Length in male about 2.8 mm; costa extended to apex of vein M_{1+2} ; wing tip nearest to vein R_{4+5} ; crossvein r-m approximately at centre of discal cell.

Male genitalia (Fig. 3-5). Hypandrium with short apodeme and broad pregonites; surstyli (Fig. 5) with 8-10 small spines; aedeagus as illustrated (Fig. 3, 4).

Colour. Frons and orbits mat black; ocellar triangle weakly shining black; mesonotum weakly shining mat black; squamae yellow, fringe dark brown.

Derivation of the specific name. — The name *brevispinata* is given in view of the small spines on surstyli.

Biology. — Not confirmed, but larvae probably mine leaves of grasses (Gramineae).

Geographical distribution. — This species is known from a single male collected at the following locality:

CANADA. Alberta: Holotype ♂ St. Albert near Edmonton, 18.vi.1967.

Agromyza canadensis Malloch

Agromyza canadensis Malloch 1913a:299; Spencer, 1969:39.

Comparison and diagnostic characters. — The members of this species are large flies, wing length approximately 3.0 mm and are distinctive in having yellowish brown legs and dark antennae.

They have male genitalia which appear indistinguishable from those of *A. pseudorufipes* Nowakowski. The two previously known Canadian specimens of this species are brownish flies (Shewell, 1953) while the members of European *A. pseudorufipes* are darker in colour. This was the basis of Spencer's (1969) accepting them as different species. The bred male from Yukon Territory, Canada, however, is darker in colour. The discovery of this dark specimen casts doubt on the separation of these two species on the basis of colour. The name *A. pseudorufipes* Nowakowski will probably prove to be a junior synonym of *A. canadensis* Malloch.

Biology. — Larvae make blotch mines on the leaves of *Mertensia paniculata* (Ait.) G. Don, family Boraginaceae. Pupation takes place outside the leaf mine.

Geographical distribution. — The members of this species are known from Western and Eastern Canada (Frick, 1959; Spencer, 1969). I have examined the following material referable to this species:

CANADA. Alberta: Numerous leaf mines on *Mertensia paniculata* (Ait.) G. Don, Edmonton, river bed near University of Alberta campus; White Mud Creek park, July to September 1968; Yukon Territory: 1 ♂ Dawson City, from leaf mines on *Mertensia paniculata* (Ait.) G. Don, 5.viii.1968, emerged 22.vi.1969, coll. G. C. D. Griffiths.

Agromyza fragariae Malloch

Agromyza fragariae Malloch 1913a:307; Spencer, 1969:42.

Comparisons and diagnostic characters. — The members of this species resemble closely those of *A. spiraeae* Kaltenbach and *A. masculina* Sehgal but differ in having distinctly brownish frons and distinctive aedeagus. The aedeagus has a characteristic sclerotization in the mesophallus as illustrated by Spencer (1969).

Biology. — Larvae are known to mine the leaves of *Fragaria virginiana* Duchesne, family Rosaceae in United States.

Geographical distribution. — The members of this species are known from United States and Canada (Spencer, 1969). From Alberta, Canada they are known from the following localities:

CANADA. Alberta: Blairmore; Onefour (Spencer, 1969).

Agromyza hockingi Spencer

Agromyza hockingi Spencer 1969:44.

Diagnostic characters. — The members of this species are small shining black flies, having pale or slightly brownish squamal fringe and distinct male genitalia. Spencer (1969) illustrated the aedeagus. The number of bristles on surstyli (Fig. 6) is variable, from three to six.

One male collected from Edmonton, White Mud Creek park, 13.vi.1966 is tentatively referred here as it has the aedeagus very similar to that of *hockingi* Spencer, but has distinctive surstyli (Fig. 7) with two very long spines and a small indistinguishable bristle. This probably represents a further species, but more material is necessary to confirm this opinion.

Biology. — Larvae probably mine leaves of grasses (Gramineae).

Geographical distribution. — Known from Alberta, New Brunswick, Ontario and Quebec (Spencer, 1969). I have examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Edmonton, White Mud Creek park, 6.vii.1966; 1 ♂ same locality, viii.1968; 2 ♀♀ same locality, 29.vi.1966; 1 ♂ Elk Island park, 2.viii.1966; 1 ♀ same locality, 31.vii.1966; 1 ♂ George Lake near Busby, 21.viii.1966.

Agromyza kincaidi Malloch

Agromyza kincaidi Malloch 1913a:285; Spencer, 1969:45.

Comparisons and diagnostic characters. — The members of this species are large shining black flies, wing length about 3.0 mm, with costa extended to vein R_{4+5} and dark squamal fringe. The aedeagus (Fig. 8, 9) and surstyli are also very distinctive.

Hendel (1931) synonymised the name *kincaidi* Malloch with *ambigua* Fallén. Frick (1952, 1959) also accepted it synonymous with *ambigua* Fallén. Spencer (1965d) concluded that specimens of *ambigua* Fallén *sensu* Hendel represented *nigrella* Rondani and not the true *ambigua* Fallén. He later (1969) rejected Hendel's synonymy and re-established this species.

Biology. — Larvae probably mine leaves of grasses (Gramineae).

Geographical distribution. — Known from Alaska and widespread in Canada (Spencer, 1969). I have examined the following material from Alberta:

CANADA. Alberta: 1 ♀ Cypress Hills, Elkwater Lake, 24.vi.1966; 1 ♂ Edmonton, White Mud Creek park, 10.vi.1966, 1 ♂ same locality, 6.vii.1966; 1 ♂ same locality, viii.1968; 1 ♂ Edmonton, 110 St. 84 Ave., 15.vi.1968; 1 ♂, 2 ♀♀ Jasper, 17.vi.1966.

Agromyza masculina Sehgal

Agromyza masculina Sehgal 1968:59.

Comparisons and diagnostic characters. — The members of this species resemble externally those of *spiraeeae* Kaltenbach and *vockerothi* Spencer and can be reliably recognized by examination of the male genitalia. Sehgal (1968) illustrated the head, wing and aedeagus characteristic of this species.

Geographical distribution. — Known only from Alberta from the following localities: CANADA. Alberta: Blairmore, Okotoks.

Agromyza nearctica new species

Comparison and diagnostic characters. — The specimen of this species is distinctive in having reddish frons and 3+1 strong dorsocentrals. It is distinguished in Spencer's (1969) key to Canadian species of the genus *Agromyza* Fallén by amending and extending couplet 29 as below:

29. Third antennal segment yellow 30
 - Third antennal segment black 29a
 29a. Second and third antennal segments completely black; orbits black; frons distinctly projected in profile; aedeagus as in Fig. 10 *nearctica* n. sp.
 - Third antennal segment black sp. indet. (Spencer)

Description. — Head. Frons approximately twice width of eye at level of front ocellus distinctly projected in front of eye margin in profile. Two strong Ors directed upwards; three Ori directed inwards and upwards; orbital setulae numerous, reclinate. Orbits broad, each approximately one-fifth frons width. Eyes oval, 1.2 times higher than their length, bare; ocellar triangle small. Gena approximately one-fourth eye height. Third antennal article rounded at tip, with normal pubescence; arista normal, pubescent.

Mesonotum. Dorsocentrals 3+1 strong bristles; acr numerous, approximately in six rows; strong prescutellars present.

Wing. Length in male approximately 2.5 mm; costa extended to vein R_{4+5} ; costal segments 2-4 in the ratio of 1 : 0.22 : 0.21; crossvein m-m present; basal portion of M_{3+4} slightly longer than distal (1 : 0.9).

Male genitalia (Fig. 10-12). Hypandrium (Fig. 12) V-shaped, with narrow side arms and short but distinct apodeme; pregonites broad; postgonites elongate; surstyli with approximately 8 spinules placed anteriorly; cerci long; aedeagus (Fig. 10) characteristic with bag of spinules between two arms of basiphallus as illustrated; ejaculatory apodeme (Fig. 11) small and narrow, bulb small, membranous.

Colour. Frons reddish; orbits black; gena paler; lunule reddish; ocellar triangle weakly shining black; both Vt 's on dark ground; first antennal article reddish; second and third antennal articles black; mesonotum, scutellum and pleura mat black; legs black, only distal tips of femora yellow; squamae yellow, fringe light brown; halteres yellow.

Derivation of the specific name. — The name *nearctica* indicates that the known member of this species is from the Nearctic.

Geographical distribution. — This species is known from a single male from the following locality:

CANADA. Alberta: Holotype ♂ Edmonton, Mayfair park, 1.vi.1969.

Agromyza nigripes Meigen

Agromyza nigripes Meigen 1830:170; Shewell, 1953:462; Spencer, 1969:50.

Comparison and diagnostic characters. — The members of this species resemble closely those of *A. albipennis* Meigen and are separated reliably by examination of the characters of male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — In Europe the larvae are known to mine the leaves of various genera belonging to the tribes Glycerieae, Aveneae and Agrostae of the family Gramineae (Griffiths, 1963).

Geographical distribution. — The members of this species are known from Europe and Canada (Spencer, 1969). From Alberta, Canada they are known from the following localities:

CANADA. Alberta: Red Deer; St. Albert near Edmonton, Spencer (1969).

Agromyza populoides Spencer

Agromyza populoides Spencer 1969:52.

Diagnostic characters. — The members of this species are very distinctive in having pale squamal fringe, characteristic aedeagus (Spencer, 1969, Fig. 53) and biology.

Biology. — Larvae make large black blotch mines on *Populus* spp., family Salicaceae.

Geographical distribution. — Known from United States, and Alberta, Ontario, Quebec and Saskatchewan in Canada. I have examined the following material from Alberta:

CANADA. Alberta: Paratype 1 ♂ Edmonton, University of Alberta campus, near Aberhart Hospital, 1.vi.1966; 1 ♂ Edmonton, White Mud Creek park, from leaf mines on *Populus tremuloides* Michx., coll. 4.ix.1968, emerged 15.iii.1969; 1 ♀ same data, emerged 3.vi.1969.

Agromyza pseudoreptans Nowakowski

Agromyza urticae Nowakowski 1964:192 (Preoccupied).

Agromyza pseudoreptans Nowakowski 1967:658; Spencer, 1969:54.

Agromyza reptans; Frick, 1952:373 (not Fallén 1823a).

Diagnostic characters. — The members of this species had previously been confused with *reptans* Fallén, but possess very distinct male genitalia. Nowakowski (1964) illustrated the distinctive male genitalia of a specimen of this species under the name *urticae* Nowakowski. Frick (1952) also illustrated the characteristics of this species under the name *reptans*.

Biology. — Larvae make irregular blotch mines on the leaves of *Urtica* spp., family Urticaceae.

Geographical distribution. — Known from Europe, Japan, United States and Canada (Spencer, 1969). I have examined the following material from Alberta:

CANADA. Alberta: 1 ♀ Blairmore, 4.ix.1966, det. K. A. Spencer

Agromyza spiraeae Kaltenbach

Agromyza spiraeae Kaltenbach 1867:104; Spencer, 1969:55.

Comparisons and diagnostic characters. — The diagnostic characters of the members of this species are: frons mat black, not projected in front of eye margin in profile; mesonotum and scutellum weakly shining black; wing length approximately 2.4 mm; costa extended to vein M_{1+2} ; Spencer (1969) figured the distinctive aedeagus.

The adults resemble those of *A. vöckerothi* Spencer and *A. masculina* Sehgal and are separated by characteristics of male genitalia. The description of *A. spiraeae* Kaltenbach

from Japan indicates a probable further species because of slight differences in the structure of distiphallus as figured by Sasakawa (1961).

Biology. — Larvae mine leaves of various members of the subfamily Rosoideae, family Rosaceae (Hering, 1954).

Geographical distribution. — The members of this species are widespread in North America and Central Europe (Hering, 1954; Spencer, 1969). I have examined the following material from Alberta:

CANADA. Alberta: 1 ♂, 1 ♀ Jasper, 19.vi.1966.

Agromyza sulfuriceps Strobl

Agromyza sulfuriceps Strobl 1898:270; Spencer, 1969:58.

Diagnostic characters. — The members of this species are small flies, wing length approximately 2.4 mm (Spencer, 1969). The main distinguishing characters are: antennae yellow, frons yellowish below and darker above, orbits black; mesonotum mat grey, legs black, costa extended to vein M_{1+2} , wing tip near apex of vein M_{1+2} ; aedeagus as illustrated by Spencer (1969).

Biology. — Larvae mine leaves of various members of the family Rosaceae in Europe and United States.

Geographical distribution. — The members of this species are Holarctic in distribution and are known from North America, Europe and Mongolia (Spencer, 1969). From Alberta, Canada they are known from the following locality:

CANADA. Alberta: Wabamun (Spencer, 1969).

Agromyza vockerothi Spencer

Agromyza vockerothi Spencer 1969:60.

Comparison and diagnostic characters. — The members of this species resemble those in the *spiraeae* group and differ only in having a mid-tibial bristle. The examination of male genitalia is necessary for correct identification. Spencer (1969) illustrated the aedeagus, characteristic of this species.

Geographical distribution. — Known from Alberta, British Columbia, Ontario and Nova Scotia (Spencer, 1969). I have examined the following material from Alberta:

CANADA. Paratypes 2 ♂♂ Elk Island park, 31.vii.1966.

Genus *Melanagromyza* Hendel

Melanagromyza Hendel 1920:126.

The distinguishing characters of the genus *Melanagromyza* Hendel are: subcosta developed throughout its length and coalesced with R_1 before contact with costa; normally two to three pairs of dorsocentrals, four only in *setifrons* (Melander); halteres black; prescutellars lacking; antennal bases approximate; conspicuous facial keel lacking; aedeagus with basiphallus U-shaped; posterior puparial spiracles normally with black horn or scar in centre.

This genus is represented in Alberta by nine species. Three new species are described in this treatment. The members of this genus are mostly stem borers as shown by the known life histories of four Albertan species: *achilleana* n. sp. and *bidenticola* n. sp. feed on Compositae; *martini* Spencer on Urticaceae, and *actaeae* n. sp. on Ranunculaceae. Three further males tentatively discussed here as *Melanagromyza* sp. might represent a new species. But as the males of a closely related species *actaeae* n. sp. have not been bred these specimens

cannot be definitely determined for the time being.

Key to Alberta species of the genus *Melanagromyza* Hendel

- 1(0). Squamal fringe pale or white 2
 - Squamal fringe dark, black or brown 5
 2(1). Orbits distinctly projected above eyes in profile 3
 - Orbits not significantly projected above eyes in profile 4
 3(2). Posterior puparial spiracles widely separated, each with approximately 30 bulbs; larva stem borer in *Actaea* *actaeae* n. sp., p. 305
 - Posterior puparial spiracles approximate, each with 15-18 bulbs; larva stem borer in *Urtica* *martini* Spencer, p. 308
 4(2). Orbits about one-fourth width of frons, not projected above eyes in profile; orbital setulae numerous, in three irregular rows; aedeagus as in Fig. 27 *bidenticola* n. sp., p. 306
 - Orbits about one-fifth width of frons, slightly projected above eyes in profile; orbital setulae fewer, in two rows; aedeagus as in Fig. 14. *achilleana* n. sp., p. 304
 5(1). Dorsocentrals 3 or 4; larger specimens, wing length 3.2 mm *setifrons* (Melandar), p. 308
 - Dorsocentrals 2, at most 3; smaller specimens 6
 6(5). Frons strongly projected 7
 - Frons not significantly projected *occidentalis* Spencer, p. 308
 7(6). Abdomen greenish, broad, low keel separating base of antennae *shewelli* Spencer, p. 309
 - Abdomen black, facial keel normal 8
 8(7). Orbits and ocellar triangle distinctly shining black *fastosa* Spencer, p. 307
 - Orbits and ocellar triangle not shining black. *laetifica* Spencer, p. 308

Melanagromyza achilleana new species

Comparisons. — The members of this species differ from those of a similar species, *M. matricarioides* Spencer, in having proclinate orbital setulae and distinct male genitalia (Fig. 14). *M. achilleana* and *M. bidenticola* n. sp. described below are distinguished in Spencer's (1969) key to Canadian species of the genus *Melanagromyza* Hendel by amending and extending the couplet 8 as below:

8. Orbits conspicuously broad, each almost one-third width of frons 9
 - Orbits narrower, at most one-quarter width of frons 8a
 8a. Orbital setulae proclinate, with few reclinate hairs below. 8b
 - Orbital setulae erect or reclinate, not proclinate above. 10
 8b. Orbits about one-quarter width of frons, not projected above eyes in profile; orbital setulae numerous, in three irregular rows, aedeagus as in Fig. 27 ... *bidenticola* n. sp.
 - Orbits about one-fifth width of frons, slightly projected above eyes in profile; orbital setulae fewer, in two rows; aedeagus as in Fig. 14 *achilleana* n. sp.

Description. — Head (Fig. 13). Frons slightly broader than width of eye (1.0 : 0.9) at level of front ocellus, slightly projected above eye margin in profile; orbits broad, approximately one-fifth of frons width; ocellar triangle small; lunule almost semicircular above; eyes oval approximately 1.3 times higher than their length, hairy; gena deepest at middle, approximately one-fifth of eye height; two strong Ors directed upwards; two Ori directed inwards; distance between Ori approximately three times distance between upper Ori and lower Ors; orbital setulae numerous, in two irregular rows, largely proclinate, with few reclinate hairs

below; antennal bases approximate; third antennal article rounded at tip; arista long and pubescent.

Mesonotum. Two strong postsutural dc; acr numerous, in 10-11 irregular rows.

Leg. Mid-tibia with two strong bristles medially.

Wing. Length 2.2 mm in ♂♂, 2.6 mm in ♀♀; costa extended strongly to vein M_{1+2} ; wing tip nearest to apex of vein R_{4+5} ; crossvein r-m beyond middle of discal cell; distal section of M_{3+4} approximately 0.7 times basal section.

Male genitalia (Fig. 14-17). Hypandrium (Fig. 16) with distinct apodeme, side arms and pregonites broad; surstyli (Fig. 17) with group of conspicuous spines anteriorly; aedeagus (Fig. 14) with basiphallus U-shaped and close to distiphallus complex; ejaculatory apodeme (Fig. 15) broad, bulb small and well sclerotized.

Colour. Frons mat black; orbits and ocellar triangle weakly shining black; antennae black; mesonotum, scutellum and abdomen shining black with greenish lustre; halteres and legs black; squamal fringe and margin pale or white.

Description of immature stages. — Puparium creamish yellow, elongate and cylindrical in shape, measures 3.0 x 1.3 mm.

Larval mouth parts obtained from puparium are illustrated (Fig. 18). Mandibles sickle-shaped, left larger than right, each with large apical and small second tooth; short U-shaped sclerite present above mandibles; lateral sclerites at base of mandibles well developed; labial sclerite short and darkly sclerotized; paraclypeal phragmata approximately 2.5 times length of labial sclerite, weakly sclerotized.

Muscle scars on abdominal segments elongate anteroposteriorly; tubercles small and scattered.

Anterior spiracles (Fig. 19) short, with eight small bulbs arranged in two rows; posterior spiracles (Fig. 20) widely separated, with almost complete circlet of 10-11 bulbs; small black horn present in centre of posterior spiracles.

Derivation of the specific name. — This species is named after the genus of its larval food plant, *Achillea sibirica* Ledeb.

Biology. — Larva feed inside the stem of *Achillea sibirica* Ledeb., family Compositae. Pupation occurs inside the stem during August-September.

Geographical distribution. — The members of this species are known only from type locality:

CANADA. Alberta: Holotype ♂ Elk Island park, from stems of *Achillea sibirica* Ledeb., emerged 12.viii.1967; Paratypes 2 ♀♀ same data.

Melanagromyza actaeae new species

Comparisons. — The members of this species resemble those of *M. martini* Spencer in external morphology, but have distinct biology and larval morphology. This species is distinguished in Spencer's (1969) key to Canadian species of the genus *Melanagromyza* Hendel by amending and extending couplet 6 as below:

6. Orbits shining black, very strongly projected; large species, wing length 3.4 mm in male *miranda* Spencer
 - Orbits weakly shining; smaller species, wing length 2.5-3.0 mm 6a
 6a. Posterior puparial spiracles widely separated, each with approximately 30 bulbs; larva stem borer in *Actaea* *actaeae* n. sp.
 - Posterior puparial spiracles approximate, each with 15-18 bulbs; larva stem borer in *Urtica* *martini* Spencer

Description. — Head (Fig. 21). Frons broad, approximately twice width of eye at level of

front ocellus, distinctly projected in front of eye margin in profile; orbits narrow, each about one-sixth of frons width; ocellar triangle small; lunule higher than semicircle along upper margin; eyes oval, approximately 1.2 times higher than their length, almost bare or with very fine pubescence; gena deepest at middle, approximately one-fourth eye height; two Ors directed upwards; 3 Ori directed inwards; distance between lower and middle Ori about three times distance between middle and upper Ori; orbital setulae numerous, in two to three rows, erect or reclinate below and proclinate above; antennal bases approximate; third antennal article rounded at tip.

Mesonotum. Two distinct postsutural dc; acr numerous, in 10-12 irregular rows.

Leg. Mid-tibia with one or two small bristles medially.

Wing. Length 3.0 mm in ♀♀, costa extended to vein M_{1+2} ; apex of vein R_{4+5} nearest wing tip; crossvein r-m slightly beyond middle of discal cell; distal portion of M_{3+4} approximately 0.7 times basal portion.

Colour. Frons mat black, orbits and ocellar triangle weakly shining black; lunule and antennae black; mesonotum, scutellum and abdomen shining black with slight greenish lustre; legs and halteres black; squamal margin and fringe pale or white.

Description of immature stages. — Puparium yellow, elongate and cylindrical in shape, measures 4.0 mm x 1.5 mm.

Larval mouth parts obtained from puparium are illustrated (Fig. 22). Mandibles sickle-shaped, left larger than right, each with large apical and small lower tooth; short U-shaped sclerite present above the mandibles; labial sclerite small and darkly sclerotized; paraclypeal phragmata approximately 3.0 times labial sclerite, weakly sclerotized.

Muscle scars (Fig. 23) on abdominal segments elongate anteroposteriorly; tubercles small and scattered.

Anterior spiracles (Fig. 24) short with 16 small bulbs arranged in two rows; posterior spiracles (Fig. 25) widely separated, each with approximately 30 small scattered bulbs, distinct horn present in the centre of each spiracle.

Derivation of the specific name. — This species is named after the genus of its larval food plant.

Biology. — The larvae feed inside the stems of *Actaea rubra* (Ait.) Willd, family Ranunculaceae. The host plant, commonly known as Red and White Baneberry, is fairly common in moist places in forests near Edmonton. This is the first *Melanagromyza* species to be recorded whose members feed on plants of the family Ranunculaceae.

Geographical distribution. — Known only from the locality of type specimens as below:

CANADA. Alberta: Holotype ♀ Edmonton, White Mud Creek park, from stems of *Actaea rubra* (Ait.) Willd., coll. 4.ix.1968, emerged 27.x.1968; Paratypes 3 ♀♀ same data, coll. 4-6.ix.1968, emerged 18-23.x.1968. One paratype female presented to K. A. Spencer.

Melanagromyza bidenticola new species

Comparison. — The members of this species differ from those of a similar species *M. virens* (Loew) in having narrower orbits and distinct male genitalia. This species is distinguished in Spencer's (1969) key to Canadian species of the genus *Melanagromyza* Hendel as shown earlier at the beginning of the description of *M. achilleana* n. sp.

Description. — Head (Fig. 26). Frons slightly broader than width of eye (1 : 0.9) at level of front ocellus, not projected in front of eye margin in profile; orbits broad, approximately one-fourth of frons width; ocellar triangle small; lunule higher than semicircle along upper margin; eyes oval, approximately 1.2 times higher than their length, hairy; gena deepest at middle, approximately one-seventh of eye height; two strong Ors directed upwards; two Ori

directed inwards; orbital setulae numerous, in about three irregular rows, largely proclinate, with erect or reclinate hairs below; antennal bases approximate; third antennal article rounded at tip, arista pubescent.

Mesonotum. Two strong postsutural dc; acr numerous, in 12-15 irregular rows.

Leg. Mid-tibia with two strong bristles medially.

Wing. Length 2.5-2.8 mm; costa extended to vein M_{1+2} ; wing tip near the apex of vein R_{4+5} ; crossvein r-m slightly beyond middle of discal cell; distal portion of M_{3+4} approximately 0.7 times basal portion.

Male genitalia (Fig. 27, 28). Hypandrium (Fig. 28) with short, broad apodeme, side arms and pregonites broad; surstyli with small spines at base; aedeagus (Fig. 27) with basiphallus U-shaped and close to distiphallus complex; distiphallus as illustrated, ejaculatory apodeme broad, bulb small and well sclerotized.

Colour. Frons and orbits mat black; ocellar triangle weakly shining black; lunule and antennae black; mesonotum, scutellum and abdomen shining black with distinct greenish and coppery lustre; halteres and legs black; squamal margin and fringe pale or white.

Description of immature stages. — Puparium pale yellow, elongate and cylindrical in shape, measures 3.4 mm x 1.3 mm.

Larval mouth parts obtained from puparium are illustrated (Fig. 29). Mandibles sickle-shaped, left larger than right, each with large apical and small lower tooth; short U-shaped sclerite present above mandibles; labial sclerite short and more darkly sclerotized along lower margins; paraclypeal phragmata approximately 3.0 times length of labial sclerite, weakly sclerotized.

Muscle scars on abdominal segments elongate anteroposteriorly; tubercles small and scattered.

Anterior spiracles (Fig. 30) short with about 10-11 bulbs arranged in two rows; posterior spiracles (Fig. 31) widely separated, each with almost complete cirlet of 15-17 small bulbs, small distinct horn present in centre of each spiracle.

Derivation of the specific name. — This species is named after the genus of its larval food plant.

Biology. — Larvae feed and pupate inside the stems of *Bidens cernua* L., family Compositae. Puparia are found inside the stems during August-September. Puparia remain inside the stems during winter and the flies emerge towards the end of June. Specimens of *Bidens cernua* L. are fairly abundant around Edmonton along stream banks.

Geographical distribution. — The members of this species are known only from the type locality:

CANADA. Alberta: Holotype ♂ Edmonton, Rainbow Valley, from stems of *Bidens cernua* L., coll. 9.x.1967, emerged 25.xi.1967; Allotype ♀ same locality and host, coll. 9.x.1967, emerged 22.xi.1967; Paratypes 21 ♂♂ and 9 ♀♀ same locality and host, coll. 9.x.1967, emerged 16-25.xi.1967; 3 ♂♂ and 1 ♀ same data, emerged x.1967.

Melanagromyza fastosa Spencer

Melanagromyza fastosa Spencer, 1969:67.

Comparison and diagnostic characters. — The members of this species differ from those of a similar species, *laetifica* Spencer, in having shining black orbits and ocellar triangle and deep gena, about one-fourth to two-fifths eye height. Spencer (1969) has figured the distinctive aedeagus.

Geographical distribution. — Known only from Alberta and Quebec. Known Alberta locality is as follows:

CANADA. Alberta: Onefour (Spencer, 1969)

Melanagromyza laetifica Spencer

Melanagromyza laetifica Spencer, 1969:68.

Diagnostic characters. — The main diagnostic characters of the members of this species are: strongly projected frons, dark squamal fringe and abdomen. Spencer (1969) has illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known only from Alberta and Manitoba in Canada (Spencer, 1969). Alberta localities are:

CANADA. Alberta: Manyberries, Mountain View.

Melanagromyza martini Spencer

Melanagromyza martini Spencer, 1969: 70.

Comparison and diagnostic characters. — The members of this species resemble those of *M. actaeae* n. sp. but have different biology and larval morphology as shown in the key. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae feed inside the stems of *Urtica*, family Urticaceae.

Geographical distribution. — The members of this species are known from Alberta, British Columbia, Ontario and Saskatchewan in Canada (Spencer, 1969). I have examined the following material from Alberta:

CANADA. Alberta: Paratype 1 ♂ Blairmore, 26.vi.1966; 1 ♀ same data; 1 ♂ and 1 ♀ Edmonton, Rainbow Valley, from stems of *Urtica gracilis* Ait. (Urticaceae), emerged 24.iii.1968; 1 ♀ Edmonton, White Mud Creek park, 23.vi.1966; Paratype 1 ♂ George Lake, near Busby, 1.vii.1966; 2 ♀♀ same locality, 1-5.vii.1966.

Melanagromyza occidentalis Spencer

Melanagromyza occidentalis Spencer, 1969:73.

Diagnostic characters. — The main distinguishing characters of the members of this species are dark squamal fringe, frons normally not projected, mat black mesonotum and greenish abdomen. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known from Alberta, British Columbia and Saskatchewan in Canada (Spencer, 1969). The Alberta localities are:

CANADA. Alberta: Banff, Elkwater and Jasper

Melanagromyza setifrons (Melander)

Agromyza setifrons Melander, 1913:260.

Melanagromyza setifrons (Melander) Frick, 1959:366; Spencer, 1969:75.

Diagnostic characters. — The main distinguishing characters of the members of this species are dark squamal fringe and three or four dorsocentrals. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known from United States, and Alberta and British Columbia in Canada. The Alberta locality is as below:

CANADA. Alberta: Blairmore (Spencer, 1969).

Melanagromyza shewelli Spencer

Melanagromyza shewelli Spencer, 1969:75.

Diagnostic characters. — The main distinguishing characters of the members of this species are: dark squamal fringe, distinctly projected orbits, facial keel and deep gena. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known from Alberta and British Columbia in Canada (Spencer, 1969). The Alberta localities are:

CANADA. Alberta: Frank and Mountain View.

Melanagromyza sp.?

Comparisons and diagnostic characters. — The males resemble externally those of *M. actaeae* n. sp., but as the males of the latter species have not been bred, these males cannot be definitely associated. The aedeagus (Fig. 32) has a characteristic gap between basiphallus and distiphallus. Such a gap is also characteristic of *Melanagromyza* sp. (Steyskal) (Spencer, 1969) and *M. angelicae* (Frost), but the adults differ from them in having narrower orbits and smaller size. The wing length in male is about 2.5 mm.

Geographical distribution. — I examined three males from the following localities:

CANADA. Alberta: 1 ♂ Edmonton, Emily Murphy park, 11.vi.1968; 2 ♂♂ George Lake, near Busby, 22.v.1968.

Genus *Hexomyza* Enderlein

Hexomyza Enderlein, 1936:182.

The members of this small genus are similar to those of the genus *Melanagromyza* Hendel in external morphology. Hendel (1931) included all known species in the genus *Melanagromyza* Hendel. Frick (1952) combined the members of the genus *Hexomyza* Enderlein with those of the large genus *Melanagromyza* Hendel. Later Spencer (1966a) in view of distinct male genitalia and larval biology resurrected this genus to include gall causing species.

Of the two species known in Canada only one, *H. schineri* (Giraud), has been confirmed in Alberta. The other species, *H. albicula* Spencer, gall producer on *Salix* twigs, probably also occurs in Alberta.

Hexomyza schineri (Giraud)

Agromyza schineri Giraud, 1861:484.

Melanagromyza schineri (Giraud), Hendel, 1920:128; Frick, 1952:379.

Hexomyza schineri (Giraud), Spencer, 1966a:42, 1969:81.

Comparison and diagnostic characters. — The members of this species differ from those of *H. albicula* Spencer in having costa extended to apex of vein M_{1+2} , and distinct male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae produce twig galls on *Populus tremuloides* Michx., family Salicaceae.

Geographical distribution. — The members of this species are known from Western Europe, U. S. A. and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: Empty galls on *Populus tremuloides* Michx. Edmonton, August-September 1967; 1 larva, Elk Island park, same host, November 1969, coll. G. C. D. Griffiths; 1 larva, George Lake, from same host, 29.iv.1967.

Genus *Ophiomyia* Braschnikov

Agromyza Fallén, subgenus *Ophiomyia* Braschnikov, 1897:40.

Ophiomyia Braschnikov; Hendel, 1920:128.

The main distinguishing characters of the genus *Ophiomyia* Braschnikov are: subcosta developed throughout its length and coalesced with R_1 before contact with costa; two to three pairs of dorsocentrals; halteres black; prescutellars lacking; antennal bases usually separated by distinct, bulbous facial keel; aedeagus with basiphallus elongate, with two distinct side arms.

The species in this genus are extremely difficult to separate on the basis of external morphology alone. Recent examination of characters of the male genitalia of most of North American species (Spencer, 1969) has greatly facilitated the identification of closely related species. The species in the *pulicaria* group, *decima* Spencer, *pulicaria* (Meigen) and *pulicarioides* Sehgal, resemble externally those in the genus *Melanagromyza* Hendel, but possess aedeagus typical of the genus *Ophiomyia* Braschnikov. Spencer (1964c) transferred species in the *pulicaria* group from the genus *Melanagromyza* Hendel to the genus *Ophiomyia* Braschnikov due to similarities in the characters of the male genitalia.

The genus is represented in Alberta by 17 species. The members of this genus usually mine below the stem epidermis of various herbaceous plants, but a few mine the tissue in the leaf. Biology of most species in Alberta remains to be determined as information is available about host-plants of only four species.

Key to Alberta species of the genus *Ophiomyia* Braschnikov

- | | | |
|--------|---|-------------------------------------|
| 1(0). | Antennal bases separated by distinct, swollen facial keel or male with vibrissal horn or both | 4 |
| - | Antennal bases not separated by distinct keel; vibrissa normal; aedeagus with basiphallus elongate, with two distinct side arms | 2 |
| 2(1). | Peristomal hairs long, conspicuous | <i>decima</i> Spencer, p. 311 |
| - | Peristomal hairs normal | 3 |
| 3(2). | Aedeagus as in Fig. 35 | <i>pulicaria</i> (Meigen), p. 314 |
| - | Aedeagus as illustrated (Fig. 12, Sehgal, 1968). | <i>pulicarioides</i> Sehgal, p. 314 |
| 4(1). | Orbital setulae proclinate, upper orbital bristles lacking in male; three pairs of postsutural dorsocentrals | <i>nasuta</i> (Melander), p. 312 |
| - | Orbital setulae reclinate | 5 |
| 5(4) | Costa extended to apex of vein R_{4+5} , male without vibrissal fasciculus | 6 |
| - | Costa extended to apex of vein M_{1+2} , male with vibrissal fasciculus | 7 |
| 6(5). | Squamae pale, margin slightly darker, facial keel narrow | <i>banffensis</i> Spencer, p. 311 |
| - | Squamae darker grey, margin dark brown; facial keel broader | <i>monticola</i> Sehgal, p. 312 |
| 7(5). | Vibrissal angle at most 60° | 8 |
| - | Vibrissal angle between 70° and 90° | 13 |
| 8(7). | Gena deep, one-fourth to one-third eye height | 9 |
| - | Gena narrower, one-tenth to one-sixth eye height | 10 |
| 9(8). | Vibrissal fasciculus broad at base incompletely fused | <i>praecisa</i> Spencer, p. 313 |
| - | Vibrissal fasciculus long and compact | <i>stricklandi</i> n. sp., p. 315 |
| 10(8). | Large specimens, wing length 2.5 mm; aedeagus as illustrated by Spencer (1969) | <i>secunda</i> Spencer, p. 314 |
| - | Smaller specimens, wing length 2.2 mm or less | 11 |

- 11(10). Squamal fringe brownish, last and penultimate segments of M_{3+4} equal *undecima* Spencer, p. 315
 - Squamal fringe black 12
- 12(11). Facial keel broad, aedeagus as illustrated by Spencer (1969) *nona* Spencer, p. 313
 - Facial keel narrow, aedeagus as illustrated by Spencer (1969) *septima* Spencer, p. 314
- 13(7). Frons conspicuously projected above eyes in profile, gena deep approximately one-third eye height, 3 Ori. *sexta* Spencer, p. 314
 - Frons not projected, gena narrower at most one-fifth eye height, 2 Ori 14
- 14(13). Gena one-fifth eye height, vibrissal fasciculus with distinct curvature at end *labiatarum* Hering, p. 311
 - Gena narrower one-sixth to one-eighth eye height 15
- 15(14). Facial keel conspicuously raised below antennae, broader, aedeagus as in Fig. 34 *maura* (Meigen), p. 312
 - Facial keel narrower. 16
- 16(15). Mesonotum mat greyish *wabamunensis* Spencer, p. 316
 - Mesonotum shining black. *prima* Spencer, p. 313

Ophiomyia banffensis Spencer

Ophiomyia banffensis Spencer, 1969:83.

Comparison and diagnostic characters. — The members of this species resemble closely those of *O. monticola* Sehgal, but differ in having narrower facial keel, pale squamae and distinctive aedeagus. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known only from the locality of the type specimens as follows:

CANADA. Alberta: Banff (Spencer, 1969).

Ophiomyia decima Spencer

Ophiomyia decima Spencer, 1969: 85.

Comparison and diagnostic characters. — The members of this species resemble those in the *pulicaria* group in lacking a distinct vibrissa in male and distinct facial keel. The facial keel is only weakly developed. The main distinguishing characters are the conspicuous peristomal hairs and distinctive aedeagus. Spencer (1969) illustrated the distinctive aedeagus.

Geographical distribution. — The members of this species are known only from the type locality:

CANADA. Alberta: Cypress Hills (Spencer, 1969).

Ophiomyia labiatarum Hering

Ophiomyia labiatarum Hering, 1937:509; Spencer, 1964c:793, 1969:87.

Diagnostic characters. — The main distinguishing characters of the members of this species are dark squamal fringe, broad gena, reclinate orbital setulae and a distinct curvature in the vibrissal fasciculus. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Not confirmed in Alberta, but larvae are known to mine below the stem epidermis of various genera of Labiatae in Europe and United States (Spencer, 1969).

Geographical distribution. — Members of this species are known in Europe, United States and Alberta, Ontario and Quebec in Canada (Spencer, 1969). The Alberta localities are:

CANADA. Alberta: Edmonton, White Mud Creek park; Elk Island park; George Lake near Busby; Wabamun Lake near Sundance.

Two additional Alberta specimens listed below are only provisionally referred here as they are not separable externally, but the aedeagus (Fig. 33) has slight differences in the shape of the distiphallus.

CANADA. Alberta: 1 ♂ Edmonton, White Mud Creek park, viii.1968; 1 ♂ George Lake near Busby, 7.vi.1968, coll. G. C. D. Griffiths.

Ophiomyia maura (Meigen)

Agromyza maura Meigen, 1838:399

Ophiomyia maura (Meigen); Hendel, 1920:129, 1931:188; Sasakawa, 1961:358.

Comparison and diagnostic characters. — The adults of this species differ from those of a similar species, *O. labiatarum* Hering, having narrower gena and distinct aedeagus. The aedeagus of this species (Fig. 34) resembles that of *O. asterivora* Spencer and differs only in very minor details as the central circular area and deeper concavity on dorsal side. *O. asterivora* Spencer has a different larval mine. Sasakawa (1961) illustrated this species in detail. Spencer (1964c, 1969) also discussed this species and illustrated the aedeagus.

Biology. — The larvae make long, narrow linear mines with widely spaced frass granules on *Aster* and *Solidago*, family Compositae. Sasakawa (1961) illustrated the characteristic leaf mine.

Geographical distribution. — The members of this species are Holarctic in distribution, known from Japan (Sasakawa, 1961), Europe, North America and Canada (Spencer, 1964c, 1969). I have examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Edmonton, White Mud Creek park, 16.vii.1966; Leaf mines on *Solidago* around Edmonton, ix.1968.

Ophiomyia monticola Sehgal

Ophiomyia monticola Sehgal, 1968:60.

Comparison and diagnostic characters. — The members of this species differ from those of a closely related species, *O. banffensis* Spencer, in having darker squamae and broad facial keel. Sehgal (1968) illustrated the head, wing and male genitalia characteristic of this species. Spencer (1969) also illustrated the aedeagus.

Geographical distribution. — Members of this species are known from numerous localities in western Canada and also from Alaska (Sehgal, 1968). The Alberta localities are:

CANADA. Alberta: Banff; Cypress Hills, Elkwater; Jasper.

Ophiomyia nasuta (Melander)

Agromyza maura var. *nasuta* Melander, 1913:260.

Agromyza youngi Malloch, 1914a:312.

Ophiomyia madizina Hendel, 1920:130.

Tylomyza madizina (Hendel); Hendel, 1931:185; Frick, 1952:385; Sasakawa, 1961:359.

Siridomyza madizina (Hendel); Enderlein, 1936:179.

Tylomyza nasuta (Melander); Frick, 1957:201, 1959:372.

Ophiomyia nasuta (Melander); Spencer, 1964c:798.

Comparison and diagnostic characters. — The members of this species differ from those of a closely related Palearctic species, *O. pinguis* (Fallén), by having three dorsocentrals

and absence of upper orbital bristles in male. The proclinate orbital setulae are numerous in males, few in females. Frick (1959) illustrated the characteristic head and wing of this species as *Tylomyza nasuta* (Melander). Sasakawa (1961) illustrated this species as *Tylomyza madizina* (Hendel). Spencer (1964c, 1969) illustrated the aedeagus characteristic of this species.

Biology. — Not confirmed in Alberta, but larvae are known to mine the leaves of *Taraxacum officinale* Weber, family Compositae, in United States (Frick, 1959).

Geographical distribution. — The members of this species are Holarctic in distribution and are known from numerous localities in Europe (Spencer, 1964c), Japan (Sasakawa, 1961), North America (Frick, 1959) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 3 ♂♂, 2 ♀♀ Blairmore, 26-27.vi.1966; 6 ♂♂, 5 ♀♀ Cypress Hills, Elkwater Lake, 24.vi.1966; 2 ♂♂ Edmonton, Parliament grounds, 19.vi.1967; 1 ♂ Edmonton, Rainbow Valley, 14.vi.1968; 1 ♀ Edmonton, White Mud Creek park, 20.viii.1966; 1 ♀ same locality, 8.vi.1967; 1 ♀ same locality, 30.viii.1968 coll. G. C. D. Griffiths; 1 ♀ Edmonton, University of Alberta campus, 11.vi.1966; 1 ♂ Edmonton, 26.v.1946 coll. R. M. Mason; 1 ♂ Elk Island park, 31.vii.1966; 3 ♀♀ George Lake, near Busby, 21.vi.1966; 8 ♂♂, 5 ♀♀ Jasper, 16-19.vi.1966.

Ophiomyia nona Spencer

Ophiomyia nona Spencer, 1969:92.

Diagnostic characters. — The main distinguishing characters of the members of this species are acute vibrissal fasciculus, narrow gena, dark squamal fringe and broad facial keel. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known only from the type locality:

CANADA. Alberta: Cypress Hills, Elkwater (Spencer, 1969).

Ophiomyia praecisa Spencer

Ophiomyia praecisa Spencer, 1969:92.

Comparison and diagnostic characters. — The members of this species belong to the group having acute vibrissal angle and deeper gena. They differ from those of a similar species, *O. stricklandi* n. sp., in having broad and incompletely fused vibrissal fasciculus. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known from the localities of their type specimens as below:

CANADA. Alberta: Banff-Jasper Highway, 13 miles North of Banff; Cypress Hills, Elkwater.

Ophiomyia prima Spencer

Ophiomyia prima Spencer, 1969:93.

Diagnostic characters. — The main distinguishing characters of the members of this species are the vibrissal angle of about 80°, frons not projected, narrow facial keel and shining black mesonotum. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known only from the type locality:

CANADA. Alberta: Elk Island park (Spencer, 1969).

Ophiomyia pulicaria (Meigen)

Agromyza pulicaria Meigen, 1830:170.

Melanagromyza pulicaria (Meigen); Hendel, 1920:127, 1931:171.

Ophiomyia pulicaria (Meigen); Spencer, 1964c:802, 1969:93.

Comparisons and diagnostic characters. — The members of this species resemble externally those of *O. decima* Spencer and *O. pulicarioides* Sehgal, and are reliably separated only by characteristics of male genitalia. The aedeagus of an Alberta specimen has been illustrated (Fig. 35). Spencer (1969) also illustrated the aedeagus.

Biology. — Not confirmed in Alberta, but larvae are known to mine along the leaf midrib of various Compositae in Europe (Spencer, 1969).

Geographical distribution. — The members of this species are widespread in Europe and are known from Alberta and British Columbia in Canada (Spencer, 1969). I examined the following further material from Alberta:

CANADA. Alberta: 1 ♂ Wabamun, 1.vii.1940, coll. E. H. Strickland.

Ophiomyia pulicarioides Sehgal

Ophiomyia pulicarioides Sehgal, 1968:61.

Comparisons and diagnostic characters. — The members of this species resemble externally those of *O. decima* Spencer and *O. pulicaria* (Meigen), and are separated reliably only by examination of the characters of the male genitalia. Sehgal (1968) illustrated the head, wing and male genitalia. Spencer (1969) also figured the aedeagus.

Geographical distribution. — The members of this species are known only from the type locality:

CANADA. Alberta: Cypress Hills, Elkwater (Spencer, 1969).

Ophiomyia secunda Spencer

Ophiomyia secunda Spencer, 1969:96.

Comparison and diagnostic characters. — The members of this species differ from those of a closely related species, *O. septima* Spencer, in having larger size, wing length 2.5 mm, and distinct aedeagus. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known from type locality:

CANADA. Alberta: Elk Island park (Spencer, 1969).

Ophiomyia septima Spencer

Ophiomyia septima Spencer, 1969:96.

Diagnostic characters. — The main distinguishing characters of the members of this species are acute vibrissal angle of about 45°, narrow gena, wing length about 1.9 mm and narrow facial keel. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known from Alberta and Ontario in Canada. The Alberta locality is:

CANADA. Alberta: Jasper (Spencer, 1969).

Ophiomyia sexta Spencer

Ophiomyia sexta Spencer, 1969:98.

Diagnostic characters. — The main distinguishing characters of the members of this species are vibrissal angle of about 80° , wing length about 2.3 mm in male, conspicuously projected frons and three lower orbital bristles. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known from Alberta, Northwest Territories, Manitoba and Quebec in Canada (Spencer, 1969). The Alberta locality is: CANADA. Alberta: Cypress Hills (Spencer, 1969).

Ophiomyia stricklandi new species

Comparison. — The members of this species differ from those of a similar species, *O. praecisa* Spencer, in having long and compact vibrissal fasciculus and distinct aedeagus. They may be included in Spencer's (1969) key to Canadian species of the genus *Ophiomyia* Braschnikov by extending couplet 10 as below:

10. Lower orbits conspicuously projected above eyes in profile 10a
 - Orbits not projected 11
 10a. Vibrissal fasciculus broad at base, incompletely fused; aedeagus as illustrated (Spencer, 1969) *praecisa* Spencer
 - Vibrissal fasciculus long and compact; aedeagus as in Fig. 37 *stricklandi* n. sp.

Description. — Head (Fig. 36). Frons approximately 1.5 times width of eye at level of front ocellus; lower orbits strongly projected in front of eye margin in profile; ocellar triangle small; facial keel broad; eyes oval, approximately 1.2 times higher than their length, bare; gena strongly projected anteriorly, approximately one-fourth eye height; vibrissal angle acute; vibrissal fasciculus strong, compact and with normal curvature; two strong Ors directed upwards; two Ori directed inwards and upwards; orbital setulae few, reclinate; third antennal article rounded at tip.

Mesonotum. Two strong postsutural dc; acr numerous, in six rows.

Wing. Length 1.6 mm in male; costa extended strongly to vein M_{1+2} ; costal segments 2-4 in ratio of 1 : 0.3 : 0.22; wing tip between R_{4+5} and M_{1+2} ; crossvein r-m beyond middle of discal cell; distal section of M_{3+4} approximately equal to its basal section.

Male genitalia (Fig. 37-39). Hypandrium (Fig. 39) with narrow side arms and short apodeme, darkly sclerotized; surstyli with very small spinules anteriorly; aedeagus (Fig. 37) with basiphallus elongate and more sclerotized towards its base, distiphallus elongate, well sclerotized, with conspicuous bulb below; ejaculatory apodeme (Fig. 38) broad, bulb small and darkly sclerotized.

Colour. Frons mat black; lunule, facial keel and lower orbits dark brown; mesonotum, scutellum and abdomen shining black; legs and halteres black; squamae pale, margin and fringe brown.

Derivation of the specific name. — This species is named in honour of the late Professor E. H. Strickland, Department of Entomology, University of Alberta, Edmonton, Canada.

Geographical distribution. — I examined one specimen from the following locality: CANADA. Alberta: Holotype ♂ Medicine Hat, 8.viii.1939, coll. E. H. Strickland.

Ophiomyia undecima Spencer

Ophiomyia undecima Spencer, 1969:99.

Diagnostic characters. — The main distinguishing characters of the members of this species are acute vibrissal angle of about 60° , narrower gena, wing length about 2.2 mm, last and penultimate sections of M_{3+4} equal and slightly brownish squamal fringe. Spencer (1969)

illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known from the type locality:

CANADA. Alberta: Banff, 20 miles towards Calgary (Spencer, 1969).

Ophiomyia wabamunensis Spencer

Ophiomyia wabamunensis Spencer, 1969:101.

Comparisons and diagnostic characters. — The members of this species differ from those of the similar species, *O. maura* (Meigen) and *O. prima* Spencer, in having mat greyish mesonotum and distinct aedeagus. Spencer (1969) illustrated the distinctive aedeagus.

Geographical distribution. — The members of this species are known only from the type locality:

CANADA. Alberta: Wabamun Lake (Spencer, 1969).

Genus *Phytobia* Lioy

Phytobia Lioy, 1864:1313.

Dizygomyza (Dendromyza) Hendel, 1931:22.

Phytobia (Phytobia) Frick, 1952:390, 1959:374.

Shizukoa Sasakawa, 1963:38; Spencer, 1965a:8.

The main distinguishing characters of the members of this genus are: subcost fold-like distally, joined to costa independent of R_1 ; orbital setulae erect or reclinate; costa normally extended to apex of vein M_{1+2} , if only to R_{4+5} (*P. confessa* Spencer) then notopleural areas dark, larger specimens wing length at least 3.0 mm, scutellum dark, concolorous with mesonotum; halteres with knob white or yellow; second crossvein normally present and wing tip near the apex of vein R_{4+5} .

Nowakowski (1962) on the basis of his studies on the male genitalia restricted the genus *Phytobia* Lioy to the species placed in the subgenus *Dendromyza* Hendel and in the subgenus *Phytobia* Lioy.

The larvae of various members of this genus bore inside the cambium of many trees. Of the three species known in Alberta information about biology is available of only one, *amelanchieris* (Greene).

Key to Alberta species of the genus *Phytobia* Lioy

- 1(0). Costa extended to apex of vein R_{4+5} *confessa* Spencer, p. 317
- Costa extended to apex of vein M_{1+2} 2
- 2(1). Mesonotum with humeral and notopleural areas partly yellow; four orbital bristles, upper two reclinate *flavohumeralis* Sehgal, p. 317
- Sides of thorax black; five or six orbital bristles, only one upper orbital bristle reclinate *amelanchieris* (Greene), p. 316

Phytobia amelanchieris (Greene)

Agromyza amelanchieris Greene, 1917:314.

Phytobia (Phytobia) amelanchieris (Greene); Frick, 1952:390, 1959:375.

Diagnostic characters. — The main distinguishing characters of the members of this species are mesonotum, scutellum and pleura distinctly mat grey and five or six orbital bristles, only upper one reclinate. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Not confirmed in Alberta, but larvae are known to mine the cambium of *Amelanchier canadensis* (L.), family Rosaceae (Frick, 1959).

Geographical distribution. — The members of this species are known from United States and British Columbia, Manitoba, Ontario, Quebec and Saskatchewan in Canada (Spencer, 1969). I examined single male from the following locality:

CANADA. Alberta: 1 ♂ Edmonton, White Mud Creek park, 6.v.1969.

Phytobia confessa Spencer

Phytobia confessa Spencer, 1969:105.

Diagnostic characters. — The main distinguishing characters of the members of this species are costa extended to apex of vein R_{4+5} ; conspicuously projected frons; shining black gena and orbits; gena deep, about one-third to one-fifth eye height and wing length about 3.3 mm in male. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known from Alberta, Manitoba and Saskatchewan in Canada (Spencer, 1969). The Alberta localities are as below:

CANADA. Alberta: Jumping Pond Creek, 20 miles west of Calgary; Medicine Hat.

Phytobia flavohumeralis Sehgal

Phytobia flavohumeralis Sehgal, 1968:62.

Diagnostic characters. — The main distinguishing characters of the members of this species are yellow ring around humeral areas on mesonotum; mat greyish black mesonotum and four orbital bristles, two upper orbital bristles reclinate. Sehgal (1968) illustrated the head, wing and male genitalia characteristic of this species. Spencer (1969) also figured the aedeagus.

Geographical distribution. — The members of this species are known from Alberta, British Columbia, Manitoba, Ontario and Saskatchewan in Canada. I examined the following additional material from Alberta:

CANADA. Alberta: 2 ♂♂ George Lake, near Busby, University of Alberta, Department of Entomology, 22.v.1968, coll. G. C. D. Griffiths; 1 ♂ same locality. 22.v.1968.

Genus *Cerodontha* Rondani

Cerodontha Rondani, 1861:10; Hendel, 1932:265; Frick, 1952:397, 1959:395; Nowakowski, 1962:100, 1967:633-661; Spencer, 1969:109.

This genus was previously restricted to a small group of species having two scutellar bristles and a conspicuous spine on the third antennal segment anterodorsally. Nowakowski (1961) on the basis of his studies of the genitalia discovered marked similarities between the genus *Cerodontha* Rondani *sensu stricto* and Hendel's subgenera *Dizygomyza*, *Poemyza* and *Icteromyza*. He proposed the enlarged concept for the genus *Cerodontha* Rondani and included above-mentioned subgenera. Spencer (1963, 1969) and other workers in the family Agromyzidae accepted this concept. Nowakowski (1967) in his recent revision of the genus *Cerodontha* Rondani proposed two new subgenera: *Butomomyza* and *Crastemyza*. The characters used to define these subgenera overlap with those in the subgenus *Dizygomyza* Hendel. Spencer (1969) included the species belonging to these subgenera in the subgenus *Dizygomyza* Hendel. The Albertan species falling in Nowakowski's subgenus *Butomomyza* are *angulata* (Loew), *eucaricis* Nowakowski, *gibbardi* Spencer, *scirpi* (Karl) and in the subgenus *Crastemyza*, *frankensis* Spencer. The above-mentioned species are included here in

the subgenus *Dizygomyza* Hendel, pending further clarification of Nowakowski's subgenera *Butomomyza* and *Crastemyza*.

The members of this genus feed exclusively on monocotyledons: Gramineae, Cyperaceae, Juncaceae and Iridaceae.

The main distinguishing characters of this genus are: subcosta joined to costa independent of R_1 ; costa normally extended to apex of vein M_{1+2} , if only to R_{4+5} then lunule broad and higher than semicircle (*Cerodontha* (*Dizygomyza*) *frankensis* Spencer); vein M_{1+2} usually near wing tip; crossvein m-m normally present, halteres with knob white or yellow; scutellum dark and concolorous with mesonotum. Either third antennal article with conspicuous spine anterodorsally and scutellum with only two bristles (subgenus *Cerodontha* Rondani); or frons normally yellow and prescutellars absent (subgenus *Icteromyza* Hendel); or lunule broad, in form of semicircle or slightly higher, but still broad, prescutellars usually present, antennal bases widely separated, third antennal article normally greatly enlarged in male (subgenus *Dizygomyza* Hendel); or lunule substantially higher than semicircle, but conspicuously narrow (subgenus *Poemyza* Hendel).

This genus is represented in Alberta by 16 species, two in the subgenus *Cerodontha* Rondani, seven in the subgenus *Dizygomyza* Hendel, five in the subgenus *Poemyza* Hendel and two in the subgenus *Icteromyza* Hendel.

Key to Alberta species of the genus *Cerodontha* Rondani

- 1(0). Third antennal article with conspicuous spine anterodorsally; scutellum with two bristles (subgenus *Cerodontha* Rondani) 2
- Third antennal article without such spine; scutellum with four bristles 3
- 2(1). Scutellum and adjoining mesonotum with variable yellow spot; aedeagus with distiphallus comparatively short, but with elongated apical bulbs (Fig. 18c, Sehgal, 1968) *dorsalis* (Loew), p.324
- Scutellum and adjoining mesonotum mat black; aedeagus with long distiphallus, but with short apical bulbs (Fig. 18a, Sehgal, 1968) *occidentalis* Sehgal, p.324
- 3(1). Lunule broad, in form of semicircle, or slightly higher but still broad 4
- Lunule conspicuously higher than semicircle (subgenus *Poemyza* Hendel) 11
- 4(3). Frons normally yellow; prescutellars absent (subgenus *Icteromyza* Hendel). 15
- Frons normally dark; prescutellars usually present (subgenus *Dizygomyza* Hendel) 5
- 5(4). Lunule broad, in form of semicircle; third antennal article in male enlarged. 6
- Lunule broad, but conspicuously higher 7
- 6(5). All femora distally yellow; frons not projected; smaller specimens, wing length about 2.2 mm *ultima* Spencer, p.321
- Only fore femora yellow distally; frons at most slightly projected; orbits and lunule yellowish *chaixiana* (Groschke), p.319
- 7(5). Costa extended to apex of vein R_{4+5} *frankensis* Spencer, p.320
- Costa extended to apex of vein M_{1+2} 8
- 8(7). Frons conspicuously projected above eyes *gibbardi* Spencer, p.320
- Frons not projected 9
- 9(8). Squamal fringe dark; lower Ors incurved *scirpi* (Karl), p.320
- Squamal fringe yellow; Ors parallel or lower one directed slightly outwards. 10
- 10(9). Ors parallel; wing length 2.4-3.0 mm; aedeagus with distiphallus short and less sinuate *angulata* (Loew), p.319
- Lower Ors directed slightly outwards; wing length 3.0-3.2 mm; aedeagus with

	distiphallus long and more sinuate	<i>eucaricis</i> Nowakowski, p. 320
11(3).	Orbits or frons yellow	12
-	Orbits and frons dark	14
12(11).	Femora yellow only distally; notopleural area yellow	
	. . . . .	<i>superciliosa</i> (Zetterstedt), p. 323
-	Femora yellow, at least in apical one-third; notopleural areas dark	13
13(12).	Aedeagus short and rotated	<i>muscina</i> (Meigen), p. 322
-	Aedeagus with long and thread-like distiphallus	
	. . . . .	<i>calamagrostidis</i> Nowakowski, p. 321
14(11).	All femora yellow distally.	<i>inconspicua</i> (Malloch), p. 322
-	Only fore femora yellow distally	<i>incisa</i> (Meigen), p. 321
15(4).	Palpi black; larger specimens, wing length up to 3.5 mm	
	. . . . .	<i>capitata</i> (Zetterstedt), p. 323
-	Palpi yellow	<i>longipennis</i> (Loew), p. 324

Subgenus *Dizyomyza* Hendel

Dizyomyza Hendel, 1920:130.

Phytobia (*Dizyomyza*) Frick, 1952:396, 1959:383.

Cerodontha (*Dizyomyza*) Nowakowski, 1962:102, 1967:638.

This subgenus is represented in Alberta by seven known species. Biology of various species have not been confirmed in Alberta, but some information about host-plants is known for five Albertan species

Cerodontha (*Dizyomyza*) *angulata* (Loew)

Agromyza angulata Loew, 1869:47.

Phytobia (*Poemyza*) *angulata* (Loew), Frick, 1957:202, 1959:380.

Cerodontha (*Butomyza*) *semiposticata* (Hendel), Nowakowski, 1967:634.

Cerodontha (*Dizyomyza*) *angulata* (Loew), Spencer, 1969:113.

Comparison and diagnostic characters. — The members of this species differ from those of a closely related species, *eucaricis* Nowakowski, in having upper orbital bristles parallel, and short and less sinuate distiphallus. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae are known to mine the leaves of *Carex* spp., family Cyperaceae, in Europe. Pupation occurs outside the mine.

Geographical distribution. — The members of this species are known from Europe, United States and Alberta and Ontario in Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Vègreville, 22.vi.1968.

Cerodontha (*Dizyomyza*) *chaixiana* (Groschke)

Phytobia (*Dizyomyza*) *chaixiana* Groschke, Hering, 1956:264.

Phytobia (*Dizyomyza*) *chaixiana* Groschke, 1957:116.

Cerodontha (*Dizyomyza*) *chaixiana* (Hering), Nowakowski, 1967:643.

Cerodontha (*Dizyomyza*) *chaixiana* (Groschke), Spencer, 1969:115.

Diagnostic characters. — The main distinguishing characters of the members of this species are the enlarged third antennal articles, yellowish orbits and lunule and distally yellow fore

femora. Spencer (1969) illustrated the aedeagus characteristic of this species. The distiphallus has a characteristic swelling distally.

Biology. — The members of this species are known to mine the leaves of *Poa* sp., family Gramineae, in Europe. Hering (1956) described the larval morphology.

Geographical distribution. — The members of this species are known from Europe, and Alberta and Ontario in Canada. I examined the following additional material from Alberta :

CANADA. Alberta: 1 ♂ Edmonton, 20.viii.1936, coll. E. H. Strickland; 1 ♂ Edmonton, White Mud Creek park, 6.vi.1966; 3 ♂♂ same locality, 28.v.-19.vi.1967; 1 ♂ same locality, 10.vi.1968, coll. G. C. D. Griffiths; 1 ♂ same locality, 7.v.1969.

Cerodontha (Dizygomyza) eucaricis Nowakowski

Cerodontha (Butomomyza) eucaricis Nowakowski, 1967:636.

Cerodontha (Dizygomyza) eucaricis (Nowakowski), Spencer, 1969:116.

Diagnostic characters. — The main distinguishing characters of the members of this species are the larger size, wing length about 3.0 mm; prescutellars present, yellow squamal fringe and lower Ors directed slightly outwards. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — The members of this species are known to mine the leaves of *Carex* sp., family Cyperaceae, in Europe.

Geographical distribution. — The members of this species are known from Europe, Alaska, and Alberta, Manitoba and Ontario in Canada (Spencer, 1969). The known Alberta locality is as follows:

CANADA. Alberta: Banff (Spencer, 1969).

Cerodontha (Dizygomyza) frankensis Spencer

Cerodontha (Dizygomyza) frankensis Spencer, 1969:119.

Comparison and diagnostic characters. — The members of this species are distinctive in having costa extended to apex of vein R_{4+5} . They resemble externally those of *C. (Dizygomyza) flavocingulata* (Strobl), but differ in having darker squamal fringe. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known from Alberta, British Columbia and Yukon Territory in Canada. I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ (Paratype) Banff, 28.vi.1966, coll. V. K. Sehgal.

Cerodontha (Dizygomyza) gibbardi Spencer

Cerodontha (Dizygomyza) gibbardi Spencer, 1969:119.

Diagnostic characters. — The main distinguishing characters of the members of this species are broad lunule, distinctly higher than semicircle and conspicuously projected frons. Spencer (1969) illustrated the aedeagus and head characteristic of this species.

Geographical distribution. — The members of this species are known from Alberta, British Columbia, Manitoba and Saskatchewan in Canada. The known Alberta locality is as follows:

CANADA. Alberta: Onefour (Spencer, 1969).

Cerodontha (Dizygomyza) scirpi (Karl)

Dizygomyza scirpi Karl, 1926:137.

Cerodontha (Butomomyza) scirpi (Karl), Nowakowski, 1967:638.

Cerodontha (Dizygomyza) scirpi (Karl), Spencer, 1969:123.

Diagnostic characters. — The members of this species are distinctive in having incurved lower Ors, and slightly darker squamal fringe. Spencer (1969) illustrated the aedeagus characteristic of this species. There is no membranous gap between meso- and distiphallus.

Biology. — Larvae mine the leaves of *Scirpus* spp., family Cyperaceae, in Europe. Pupa-tion occurs towards the base of the leaf sheath. Similar mines seen around Edmonton probably were made by members of this species.

Geographical distribution. — The members of this species are known from Europe, and British Columbia and Quebec in Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 2 ♂♂ Edmonton, Rainbow Valley, 14.vi.1968; 3 ♂♂ Edmonton, White Mud Creek park, 10.vi.1968.

Cerodontha (Dizygomyza) ultima Spencer

Cerodontha (Dizygomyza) ultima Spencer, 1969:125.

Diagnostic characters. — The members of this species are distinctive in having enlarged third antennal article and all femora distally yellow. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae mine the leaves of family Cyperaceae, *Scirpus* or *Carex* sp. (Spencer, 1969).

Geographical distribution. — The members of this species are known from Ontario, Canada. I examined the following material from Alberta.

CANADA. Alberta: 2 ♂♂ Edmonton, White Mud Creek park, 8.vi.1967 and 11.v.1969; 1 ♂ Glynde, 30.iv.1946, E. H. Strickland.

Subgenus *Poemyza* Hendel

Dizygomyza (Poemyza) Hendel, 1931:35.

Phytobia (Poemyza) Frick, 1952:391, 1959:379.

Cerodontha (Poemyza) Nowakowski, 1962:102, 1967:645.

This subgenus is represented in Alberta by five species.

Cerodontha (Poemyza) calamagrostidis Nowakowski

Cerodontha (Poemyza) calamagrostidis Nowakowski, 1967:648.

Comparison and diagnostic characters. — The members of this species can only be reliably separated from those of *C. (Poemyza) muscina* (Meigen) by examination of the characters of male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae mine the leaves of *Calamagrostis* spp., family Gramineae, in Europe.

Geographical distribution. — The members of this species are known from Europe, and Alberta in Canada. I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Edmonton, White Mud Creek park, 23.vi.1966.

Cerodontha (Poemyza) incisa (Meigen)

Agromyza incisa Meigen, 1830:182.

Dizygomyza (Poemyza) incisa (Meigen), Hendel, 1931:38.

Phytobia (Poemyza) incisa (Meigen), Frick, 1959:381.

Cerodontha (Poemyza) incisa (Meigen), Nowakowski, 1967:651.

Comparison and diagnostic characters. — The members of this species differ from those of *C. (Poemyza) inconspicua* (Malloch) in having slightly higher lunule and only fore femora distally yellow. The distiphallus is long and narrow with apical bulb. Spencer (1969) illustrated the aedeagus.

Biology. — Larvae mine the leaves of plants belonging to various genera in the family Gramineae. The known genera from Canada are *Agropyron*, *Phalaris*, *Phleum* and *Zizania*. Several larvae mine and pupate together inside the leaf.

Geographical distribution. — The members of this species are Holarctic in distribution, being known from Europe, Asia, United States and Canada. I examined the following material from Alberta:

CANADA. Alberta: 1 ♂, 1 ♀ Edmonton, 114 Street, 76 Avenue, from leaf mines on *Agropyron repens* (L.) Beauv., coll. 21.vii.1966, emerged 19-24.ii.1967; 1 ♂ Edmonton, river bank near University of Alberta campus, from leaf mines on grass, coll. 26.vi.1966, emerged 5.viii.1966; 2 ♂♂, 2 ♀♀ same locality, from leaf mines on grass, coll. 22.vi.1968, emerged 4.vii.1968; 1 ♂ Edmonton, University of Alberta campus, from leaf mines on *Phalaris arundinacea* L., coll. 24.ix.1966, emerged 15.i.1967; 3 ♀♀ same locality and host, coll. 10.x.1966, emerged 11.iii.1967; 1 ♀ same locality and host, coll. 24.ix.1966, emerged 11.iii.1967; 1 ♀ Elk Island park, 7.vi.1966.

Cerodontha (Poemyza) inconspicua (Malloch)

Agromyza inconspicua Malloch, 1913a:310.

Phytobia (Poemyza) inconspicua (Malloch), Frick, 1959:381.

Cerodontha (Poemyza) inconspicua (Malloch), Spencer, 1969:129.

Diagnostic characters. — The members of this species are distinctive in having all femora yellow on distal tips, both sections of M_3+4 almost equal and dark frons and orbits. Spencer (1969) illustrated the distinctive aedeagus. The distal tips of distiphallus are slightly dilated at apex.

Biology. — Larvae mine the leaves of *Agropyron*, family Gramineae.

Geographical distribution; — The members of this species are known from United States and Canada. I examined the following material from Alberta:

CANADA. Alberta: 2 ♂♂, 3 ♀♀ Banff, 28.vi.1966; 2 ♂♂, 3 ♀♀ Blairmore, 26.vi.1966; 3 ♂♂, 6 ♀♀ Edmonton, White Mud Creek park, 6-29.vi.1966; 1 ♂ same locality, 16.vii.1966; 2 ♂♂ same locality, viii.1968 and 31.v.1969; 2 ♂♂, 2 ♀♀ same locality, 10-18.vi.1968, coll. G. C. D. Griffiths; 1 ♂, 3 ♀♀ Elk Island park, 31.vii.1966; 1 ♂ same locality, 2.viii.1966; 3 ♂♂, 2 ♀♀ George Lake near Busby, 21.vi.1966; 1 ♀ same locality, 5.vii.1966; 1 ♀ same locality, 7.vi.1968, coll. G. C. D. Griffiths; 3 ♂♂, 4 ♀♀ Jasper, 16-19.vi.1966; 1 ♂ St. Albert, 14.vi.1966; 2 ♂♂ same locality, 18.vi.1967; 1 ♂, 4 ♀♀ Végreville, 22.vi.1968; 2 ♀♀ Vermilion, 22.vi.1968.

Cerodontha (Poemyza) muscina (Meigen)

Agromyza muscina Meigen, 1830:177.

Dizygomyza (Poemyza) muscina (Meigen), Hendel, 1931:44.

Phytobia (Poemyza) muscina (Meigen), Frick, 1959:382.

Cerodontha (Poemyza) muscina (Meigen), Nowakowski, 1967:649.

Comparison and diagnostic characters. — The members of this species differ from those of a closely related species, *C. (Poemyza) calamagrostidis* Nowakowski, only in having short

and twisted distiphallus. Spencer (1969) illustrated the distinctive aedeagus.

Biology. — Larvae mine leaves of many Gramineae. Known host genera in North America are *Agropyron*, *Ehrharta* and *Hordeum*.

Geographical distribution. — The members of this species are known from Europe, United States and Canada. I examined the following material from Alberta:

CANADA. Alberta: 1 ♀ Edmonton, Parliament Hill, 19.vi.1967; 1 ♀ Edmonton, Rainbow Valley, 14.vi.1968; 4 ♀♀ Edmonton, White Mud Creek park, 6-23.vi.1966; 1 ♂, 1 ♀ same locality, 16.vii.1966; 1 ♀ same locality, 16.viii.1966; 1 ♂ same locality, from leaf mine on grass, coll. 7.viii.1966, emerged 5.iii.1967; 1 ♂, 3 ♀♀ same locality, 28.vi.1967; 1 ♂ same locality, 8.vi.1967; 1 ♂ same locality, 10.vi.1968, coll. G. C. D. Griffiths, 2 ♂♂ Elk Island park, 31.vii.1966; 1 ♀ same locality, 4.vi.1967; 1 ♀ George Lake near Busby, 7.vi.1968, coll. G. C. D. Griffiths; 1 ♀ Red Deer, 28.vi.1966; 1 ♂ Vègreville, 22.vi.1968.

Cerodontha (Poemyza) superciliosa (Zetterstedt)

Agromyza superciliosa Zetterstedt, 1860:6455.

Cerodontha (Poemyza) superciliosa (Zetterstedt), Nowakowski, 1967:650.

Cerodontha (Poemyza) lateralis (Macquart), Spencer, 1969:131.

Diagnostic characters. — The members of this species are distinctive in having yellowish frons, orbits and notopleural areas. All femora are also yellow on distal tips.

Biology. — Larvae mine the leaves of various Gramineae. Known host genera are *Agropyron*, *Avena*, *Elymus*, *Hordeum*, *Triticum* and *Zea*.

Geographical distribution. — The members of this species are Holarctic in distribution, being known from United States, Europe, Japan, Canada and Alaska. I examined the following material from Alberta.

CANADA. Alberta: 1 ♂ Edmonton, White Mud Creek park, 23.v.1967; 1 ♀ Edmonton, 114 Street, 76 Avenue, from leaf mine on *Triticum aestivum* L., coll. 13.viii.1966, emerged 23.viii.1966.

Subgenus *Icteromyza* Hendel

Dizygomyza (Icteromyza) Hendel, 1931:51.

Phytobia (Icteromyza) Frick, 1952:392, 1959:385.

Cerodontha (Icteromyza) Nowakowski, 1962:102, 1967:654.

This subgenus is represented in Alberta by only two species discussed below.

Cerodontha (Icteromyza) capitata (Zetterstedt)

Agromyza capitata Zetterstedt, 1848:2750.

Dizygomyza (Icteromyza) capitata (Zetterstedt), Hendel, 1931:52.

Phytobia (Icteromyza) capitata (Zetterstedt), Frick, 1959:386.

Cerodontha (Icteromyza) capitata (Zetterstedt), Nowakowski, 1967:654.

Diagnostic characters. — The members of this species are distinctive in having larger size, wing length 2.5-3.5 mm and black palpi. Spencer (1969) illustrated the distinctive aedeagus.

Biology. — Larvae feed inside the stems of *Juncus* spp., family Juncaceae (Spencer, 1969).

Geographical distribution. — The members of this species are known from Europe, United States, Alaska and Canada. Known Alberta localities are:

CANADA. Alberta, Banff, Jasper, Mount Eisenhower, near Banff, Nordegg (Spencer, 1969).

Cerodontha (Icteromyza) longipennis (Loew)

Agromyza longipennis Loew, 1869:48; Shewell, 1953:46.

Phytobia (Icteromyza) longipennis (Loew), Frick, 1959:386

Cerodontha (Icteromyza) longipennis (Loew), Spencer, 1969:140.

Diagnostic characters. — The members of this species are distinctive in having yellow palpi, yellow femora distally and bare eyes. Spencer (1969) illustrated the distinctive aedeagus.

Biology. — Larvae mine the leaves of *Juncus* spp., family Juncaceae in United States.

Geographical distribution. — The members of this species are known from United States and Canada. The Alberta locality is:

CANADA. Alberta: Lethbridge (Spencer, 1969).

Subgenus *Cerodontha* Rondani

Cerodontha Rondani, 1861:10.

Cerodontha (Cerodontha) Nowakowski, 1962:100, 1967:656.

This subgenus is represented in Alberta by two species, *dorsalis* (Loew) and *occidentalis* Sehgal. Sehgal (1968) and Spencer (1969) discussed the male genitalia differences between these two species.

Cerodontha (Cerodontha) dorsalis (Loew)

Odontocera dorsalis Loew, 1863:54.

Cerodontha dorsalis (Loew), Melander, 1913:249; Frick, 1959:396.

Cerodontha (Cerodontha) dorsalis (Loew), Spencer, 1969:143.

Comparison and diagnostic characters. — The main distinguishing characters of the members of this species are scutellum and adjoining mesonotum with variable yellow spot and slightly smaller size. The aedeagus (Fig. 18c, Sehgal, 1968) is two-thirds the size of that of a closely related species, *occidentalis* Sehgal, and has distinctly elongated apical bulbs.

Biology. — Larvae mine the leaf sheaths of grasses (Gramineae).

Geographical distribution. — The members of this species are known from Mongolia, South America, United States and Canada. Material examined is as follows:

CANADA. Alberta: 1 ♂ Banff, 3.ix.1966; 2 ♂♂ Blairmore, 4.ix.1966; 1 ♂ Crowsnest, 5.ix.1966; 1 ♀ Medicine Hat, 16.vi.1928, coll. F. S. Carr, British Columbia: 1 ♂ Chilliwack, 14.x.1938, coll. J. K. Jacob; 1 ♂ Crowsnest, 26.ii.1926, coll. A. A. Denny; 1 ♂ Shuswap Lake, 22.vii.1926, coll. J. M. Dunnough. Manitoba: 1 ♂ Aweme, 17.viii.1917, coll. N. Criddle.

UNITED STATES: Indiana: 1 ♂ Lafayette, date ?, coll. J. M. Aldrich.

Cerodontha (Cerodontha) occidentalis Sehgal

Cerodontha (Cerodontha) occidentalis Sehgal, 1968:64; Spencer, 1969:144.

Comparison and diagnostic characters. — The members of this species can be reliably separated from those of a similar species, *dorsalis* (Loew), only by examination of the characters of male genitalia. The aedeagus (Fig. 18a, Sehgal, 1968) is about 1.5 times as long as in *dorsalis* (Loew). The apical bulbs on distiphallus are relatively short.

Three males collected from Banff, Alberta on June 28, 1966, are only tentatively referred here, as these most likely represent a further species. They are not separable externally from those of *occidentalis*, but the aedeagus (Fig. 40) shows conspicuous differences

in the shape of mesophallus. Since these specimens are collected from the same locality as for *occidentalis*, I prefer not to treat them as distinct species, until the range of variation in the aedeagus is more clearly defined for *occidentalis*.

Biology. — Larvae probably mine the leaves of Gramineae.

Geographical distribution. — The members of this species are known from United States, Alaska and Canada. Known Alberta localities (Sehgal, 1968) are as below:

CANADA. Alberta: Canmore, near Banff; Blairmore (Sehgal, 1968).

Genus *Calycomyza* Hendel

Dizygomyza (Calycomyza) Hendel, 1931:65.

Phytobia (Calycomyza) Frick, 1952:394, 1956:284, 1959:387.

Calycomyza Hendel, Nowakowski, 1962:97; Spencer, 1969:144.

The main distinguishing characters of this genus are subcosta joined to costa independent of R_1 ; costa extended to apex of vein M_{1+2} ; vein M_{1+2} near wing tip; crossvein m-m present, halteres with knob white or yellow; scutellum dark and concolorous with mesonotum; lunule and antennae normal; orbital setulae erect or reclinate; orbits in same plane as frons; frons yellow; notopleural areas yellow; presutural dorsocentral absent and mid-tibia in some members with a lateral bristle.

The members of this genus are difficult to separate, because of variations in colour characters. Recent studies by Spencer (1969) have indicated constant differences in male genitalia.

This genus is so far represented in Alberta by two species, *menthae* Spencer and *sonchi* Spencer. I am aware of two further species: one mines the leaves of *Solidago* and the other of *Artemisia*. These probably represent *solidaginis* (Kaltenbach) and *artemisiae* (Kaltenbach) respectively, but this would need confirmation by examination of male genitalia.

Key to Alberta species of the genus *Calycomyza* Hendel

1. Orbits shining black *sonchi* Spencer, p. 325
- Orbits paler at least in lower areas *menthae* Spencer, p. 325

Calycomyza menthae Spencer

Calycomyza menthae Spencer, 1969:152.

Comparison and diagnostic characters. — The members of this species resemble closely those of *althaeae* Spencer and *cynoglossi* Frick and can be reliably separated only by examination of characters of male genitalia. Spencer (1969) illustrated the distinctive aedeagus. The colour of squamal fringe is from pale to dark brown.

Biology. — Larvae make brownish blotch mines on the leaves of *Mentha* and *Monarda*, family Labiatae.

Geographical distribution. — The members of this species are known from Ontario and Alberta. I examined the following material from Alberta:

CANADA. Alberta: 1 ♂, 1 ♀ Edmonton, Fort Road, from leaf mines on *Mentha arvensis* L., coll. 9.viii.1969, emerged 22-25.viii.1969; 1 ♂ Edmonton, Mayfair park, 17.v.1969.

Calycomyza sonchi Spencer

Calcomyza sonchi Spencer, 1969:155.

Diagnostic characters. — The members of this species are distinctive in having shining

black orbits and pale squamal fringe. Spencer (1969) illustrated the distinctive aedeagus.

Biology. — Larvae mine the leaves of *Sonchus* and *Taraxacum*, family Compositae.

Geographical distribution. — The members of this species are known from Alberta and Manitoba in Canada. Known Alberta localities are as below:

CANADA. Alberta: Edmonton, University of Alberta campus, Red Deer.

Genus *Amauromyza* Hendel

Dizygomyza (Amauromyza) Hendel, 1931:59.

Phytobia (Amauromyza) Frick, 1952:393, 1959:377.

Amauromyza Hendel; Nowakowski, 1962:97.

Dizygomyza (Cephalomyza) Hendel; Spencer, 1969:157.

The main distinguishing characters of the members of this genus are subcosta joined to costa independent of R_1 ; costa extended to apex of vein M_{1+2} ; orbital setulae reclinate; mesonotum and scutellum black; halteres with knob black or partially paler or whitish, if yellow, aedeagus with numerous spinules on distiphallus.

This genus is represented in Alberta by two new species, *riparia* and *shepherdiae*, described below. Three species known from eastern Canada (Spencer, 1969) have not been discovered from the west.

Key to Alberta species of the genus *Amauromyza* Hendel

1. Two lower orbital bristles; gena approximately one-third eye height; aedeagus as in Fig. 43, 44 *shepherdiae* n. sp., p.327
- Three lower orbital bristles; gena approximately one-fourth eye height; aedeagus as in Fig. 41 *riparia* n. sp., p. 326

Amauromyza riparia new species

Comparison and diagnostic characters. — The members of this species differ from those of a similar species, *subinfumata* (Malloch), in having smaller size and distinct male genitalia. They may be included in Spencer's (1969) key to Canadian species of the genus *Amauromyza* Hendel as shown below at the beginning of the description of *shepherdiae* n. sp.

Description. — Head. Frons approximately twice width of eye at level of front ocellus, not projected in front of eye margin in profile. Three strong Ori directed inwards and upwards, two Ors directed upwards; orbital setulae few, approximately eight, reclinate. Eyes oval, 1.1 times higher than their length. Gena approximately one-fourth eye height. Vibrissa normal. Third antennal article rounded at tip; arista short, thickened at base.

Mesonotum. Three strong dc; acr in about five irregular rows.

Wing. Length 1.5 to 1.6 mm in ♂♂; costa extended to apex of vein M_{1+2} ; costal segments 2-4 in the ratio of 1.0 : 0.3 : 0.2; crossvein m-m present; last section of M_{3+4} approximately twice length of penultimate.

Male genitalia. Hypandrium without apodeme, postgonites elongate; aedeagus and ejaculatory apodeme as illustrated (Fig. 41, 42). Ejaculatory bulb large.

Colour. Frons, gena and face dark brown; orbits and ocellar triangle weakly shining black. Mesonotum, scutellum and pleura mat black, squamae grey, fringe black; halteres with stalk black, and knob distinctly whitish or paler.

Derivation of the specific name. — The members of this species are named *riparia* as the type specimens were caught along the river bank in Edmonton.

Geographical distribution. — The members of this species are known only from the type

locality:

CANADA. Alberta: Holotype ♂ Edmonton, river bank near University of Alberta campus, 18.v.1969; Paratypes 4 ♂♂ same locality, 18-24.v.1969; 1 ♂ Edmonton, White Mud Creek park, along river bank, 23.v.1967.

Amauromyza shepherdiae new species

Comparisons. — The members of this species differ from those of *riparia* n. sp. in having only two lower orbital bristles and distinct male genitalia. This species and *riparia* n. sp. are distinguished in Spencer's (1969) key to Canadian species of the genus *Amauromyza* Hendel, by extending his key as shown below:

2. Halteres entirely black; larger specimens, wing length 2.2 to 3.2 mm *abnormalis* (Malloch)
- Halteres with stalk black, knob whitish or yellowish grey; smaller specimens 3
3. Three lower orbital bristles 4
- Two lower orbital bristles; larvae leaf miner on *Shepherdia* *shepherdiae* n. sp.
4. Larger specimens, wing length 1.9-2.2 mm *subinfumata* (Malloch)
- Smaller specimens, wing length 1.5-1.6 mm in male *riparia* n. sp.

Description. — Head. Frons almost equal to width of eye at level of front ocellus, not projected in front of eye margin in profile. Two strong Ors directed upwards, two Ori directed inwards and upwards; orbital setulae few, approximately nine to ten reclinate hairs. Eyes oval, approximately 1.1 times higher than their length. Gena deep, approximately one-third eye height. Vibrissa normal. Third antennal article rounded at tip, arista conspicuously thickened at base, bare.

Mesonotum. Three strong dc; acr in five to six irregular rows.

Wing. Length in male 1.5 mm; costa extended to apex of vein M_{1+2} ; costal segments 2-4 in the ratio of 1.0 : 0.3 : 0.3; crossvein m-m present; last section of M_{3+4} approximately twice penultimate.

Male genitalia. Hypandrium without distinct apodeme; postgonites elongate; aedeagus as illustrated (Fig. 43, 44); ejaculatory apodeme (Fig. 45) with large bulb.

Colour. Frons, gena and face dark brown; orbits and ocellar triangle weakly shining black; mesonotum, scutellum and pleura mat black, weakly shining; antennae black; squamae grey, fringe dark brown; legs black; haltere with stalk black, knob whitish.

Derivation of the specific name. — The members of this species are named after the generic name of their food plant *Shepherdia*.

Biology. — Larvae make blotch mines (Fig. 46) on the leaves of *Shepherdia canadensis* (L.) Nutt., family Elaeagnaceae. Pupation occurs outside the mine.

Geographical distribution. — The members of this species are known from the type locality:

CANADA: Alberta: Holotype ♂ Edmonton, University of Alberta campus, from leaf mines on *Shepherdia canadensis* (L.) Nutt., coll. 5.vii.1968, emerged 25.v.1969; Numerous leaf mines, same data.

Genus *Nemorimyza* Frey

Nemorimyza Frey, 1946:42.

Nemorimyza Frey was erected as a monotypic subgenus of a large genus *Dizygomyza* Hendel *sensu lato*. Frick (1952) synonymized *Dizygomyza* Hendel with *Phytobia* Lioy *sensu lato*. Later (1953, 1959) he treated *Nemorimyza* Frey as a subgenus of *Phytobia*

Lioy. Nowakowski (1962) in view of differences in the structure of male genitalia and larval biology restricted *Phytobia* Lioy to cambium miners and raised *Nemorimyza* Frey to full generic rank.

Nemorimyza posticata (Meigen)

Agromyza posticata Meigen, 1830:172; Frost, 1924:50.

Dizygomyza (Dendromyza) posticata (Meigen); Hendel, 1931:30.

Dizygomyza (Nemorimyza) posticata (Meigen); Frey, 1946:42.

Phytobia (Phytobia) posticata (Meigen); Frick, 1952:390.

Phytobia (Nemorimyza) posticata (Meigen); Frick, 1953:69, 1959:377.

Nemorimyza posticata (Meigen); Nowakowski, 1962:97; Spencer, 1969:161.

Diagnostic characters. — The members of this species are large shining black flies, wing length approximately 3.0 mm. Other diagnostic characters are: orbits in the same plane as frons; mesonotum shining black; dorsocentrals 3+0; acrostichals approximately in six rows; prescutellars present; squamal fringe pale whitish; fore-tibial bristle present and abdomen yellowish in male. Sasakawa (1961) and Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — The larvae make blotch mines on the leaves of *Solidago* spp. in Alberta. The larvae are also known to mine the leaves of *Aster* spp. in United States (Frick, 1959). Frost (1924) and Sasakawa (1961) illustrated the leaf mine characteristic of this species. The leaf mine is characteristic in having concentric feeding marks. Pupation occurs outside the mine.

Geographical distribution. — The members of this species are Holarctic in distribution and are known from Japan (Sasakawa, 1961), Europe (Hendel, 1931), United States and Canada (Frick, 1959; Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♀ Edmonton, river bank, near University of Alberta campus, from leaf mines on *Solidago* sp., coll. 26.vii.1966, emerged 20.viii.1966; 1 ♀ same locality and host, coll. 15.vi.1969, emerged 8.vii.1969; numerous leaf mines around Edmonton; 1 ♀ Jasper, 18.vi.1966.

Genus *Liriomyza* Mik

Liriomyza Mik, 1894:289.

The main distinguishing characters of the genus *Liriomyza* Mik are: subcosta fold-like distally, joined to costa independent of R_1 ; orbital setulae erect or reclinate; costa extended to vein M_{1+2} ; vein M_{1+2} nearest wing tip; scutellum yellow at least centrally; orbits largely in plane of frons; frons usually yellow; crossvein m-m normally present, but absent in *L. singula* Spencer; aedeagus variable in shape, without sclerotized paired tubules as in the genus *Lemurimyza* Spencer.

The genus is represented in Alberta by 27 species. The species in this genus are extremely difficult to separate from external characteristics alone. The characters of male genitalia are necessary for confirmation of the specific identity of most of the species. Many species very similar in external adult characteristics often belong to very different groups when their male genitalia are studied; e.g., *L. taraxaci* Hering, *L. veluta* Spencer and *L. lathyri* new species are extremely similar in external characters; but the structure of their male genitalia suggests that they belong to entirely different groups.

Six new species described in this treatment are: *L. balcanicoides*, *L. bifurcata*, *L. lathyri*, *L. senecionivora*, *L. sinuata* and *L. sylvatica*. Necessary amendments to include these species in Spencer's (1969) key to Canadian species of the genus *Liriomyza* Mik are given.

Key to Alberta species of the genus *Liriomyza* Mik

- 1(0). Mesonotum with yellow central area adjoining scutellum. 2
- Mesonotum without such yellow area 3
- 2(1). Larger specimens, wing length 2.8-3.5 mm; acr in about five irregular rows, scutellum with dark areas laterally. *conspicua* Sehgal, p. 332
- Smaller specimens, wing length approximately 2.0 mm; acr in two rows; scutellum entirely yellow. *viciae* Spencer, p. 341
- 3(1). Crossvein m-m present 4
- Crossvein m-m absent *singula* Spencer, p. 338
- 4(3). Femora mostly dark. 5
- Femora mostly yellow, some specimens with dark spots or streaks 9
- 5(4). Third antennal article black 6
- Third antennal article yellow or slightly darkened at base of arista 7
- 6(5). Antennae entirely black; acr in four rows. *baptisiae* (Frost), p. 331
- First and second antennal article yellow; acr in two rows
. *eboni* Spencer, p. 333
- 7(5). Mesonotum shining black; acr in four rows; femora black with yellow distal tips 8
- Mesonotum black grey; acr in two rows; femora with some yellow spots or lines *socialis* Spencer, p. 339
- 8(7). Orbits mostly yellow; aedeagus with ejaculatory duct conspicuously swollen between basiphallus; distiphallus lightly sclerotized
. *septentrionalis* Sehgal, p. 337
- Orbits slightly darkened; aedeagus with ejaculatory duct not so swollen, distiphallus darkly sclerotized *cordillerana* Sehgal, p. 332
- 9(4). Third antennal article with conspicuously long pubescence 10
- Third antennal article with normal pubescence. 12
- 10(9). vte on black and vti on margin of black and yellow areas on vertex
. *sinuata* n. sp., p. 338
- vte and vti both on yellow areas. 11
- 11(10). Surstyli long and narrow; larva leaf miner on *Achillea*
. *millefolii* Hering, p. 335
- Surstyli shorter and broader. *pilosa* Spencer, p. 336
- 12(9). Squamal fringe pale yellow *lima* (Melander), p. 335
- Squamal fringe brown or black. 13
- 13(12). Mesonotum brilliantly shining black. 14
- Mesonotum dull or mat, black or grey 15
- 14(13). vte and vti on yellow areas on vertex, separated by narrow dark band
. *montana* Sehgal, p. 336
- vte on dark and vti on margin of dark and yellow areas; aedeagus as illustrated (Fig. 55, 56) *eupatorii* (Kaltenbach), p. 333
- 15(13). vte on black and vti on margin of dark and yellow areas on vertex 16
- vte and vti both on yellow areas 21
- 16(15). Upper orbits partially darkened 17
- Orbits yellow 18
- 17(16). Distiphallus with two circular lobes in ventral view
. *edmontonensis* Spencer, p. 333
- Distiphallus as illustrated (Fig. 68, 69). *sylvatica* n. sp., p. 339
- 18(16). Acrostichals in four rows 19

- Acrostichals in two rows 20
- 19(18). Femora blackish *nordica* Spencer, p. 336
- Femora normal yellow; aedeagus as in Fig. 60, 61 *senecionivora* n. sp., p. 336
- 20(18). Aedeagus with distal processes divergent as in Fig. 52, 53
- *bifurcata* n. sp., p. 331
- Aedeagus without such distal processes *kenti* Spencer, p. 334
- 21(15). Acrostichals in two rows 22
- Acrostichals in three to four irregular rows 23
- 22(21). Aedeagus with distiphallus oval, disc-shaped in ventral view
- *fricki* Spencer, p. 333
- Aedeagus as in Fig. 47, 48 *balcanicoides* n. sp., p. 330
- 23(21). One Ors and two to three Ori 24
- Two Ors and two Ori 25
- 24(23). Last section of M_{3,4} approximately two times the penultimate; larva leaf miner on *Smilacina*. *smilacinae* Spencer, p. 339
- Last section of M_{3,4} two and a half to three times the penultimate; aedeagus with long undulating process distally *undulata* Spencer, p. 340
- 25(23). Mesonotum black, not grey *taraxaci* Hering, p. 340
- Mesonotum grey 26
- 26(25). Frons slightly projected in front of eye margin in profile
- *veluta* Spencer, p. 341
- Frons not projected in front of eye margin in profile *lathyri* n. sp., p. 334

Liriomyza balcanicoides new species

Comparisons. — A member of this species resembles that of *L. fricki* Spencer in external characteristics and can be reliably separated only by examination of male genitalia. The aedeagus (Fig. 47, 48) characteristic of this species is of same general type as that of the Palaearctic species *L. balcanica* (Strobl) as figured by Spencer (1966c), but is quite distinctive. Besides, the adult differs in having crossvein m-m present. This species may be included in Spencer's (1969) key to Canadian species of the genus *Liriomyza* Mik by amending and extending couplet 39 as below:

- 39. acr in two rows. 39a
- acr in three to four rows 40
- 39a. Aedeagus as illustrated (Spencer, 1969) *fricki* Spencer
- Aedeagus as in Fig. 47, 48 *balcanicoides* n. sp.

Description. — Head. Frons approximately one and a half times width of eye at level of front ocellus, projected in front of eye margin in profile; eyes oval, 1.25 times higher than their length; gena little less than one-third of eye height midway between vibrissal and posterior margins; ocellar triangle small; lunule high; two strong Ors directed upwards; two Ori, lower one directed inwards, upper one directed upwards; orbital setulae few, three to four, reclinate; third antennal article rounded at tip, with normal pubescence; arista pubescent.

Mesonotum. Dorsocentrals 3+1; acr in two rows.

Wing. Length in male approximately 1.5 mm; costa extended to vein M₁₊₂; costal segments 2-4 in the ratio of 1 : 0.27 : 0.3; crossvein m-m present; last segment of M_{3,4} approximately two and a half times the penultimate.

Male genitalia (Fig. 47-50). Hypandrium U-shaped with slender side arms; pregonites broad; postgonites elongated; surstylus (Fig. 50) with characteristic spine placed anteriorly and a small spine dorsally on epandrium; aedeagal apodeme darkly sclerotized; phallosphere

small; basiphallus with swollen ejaculatory duct; distiphallus as illustrated with two characteristic processes at distal end; ejaculatory apodeme (Fig. 49) broad, with darkly sclerotized stem, bulb small, sclerotized along lower margin.

Colour. Frons, orbits, lunule, gena and antennae yellow; vte and vti on yellow areas; mesonotum mat greyish black; humeral area yellow, with a dark spot anteriorly; notopleural area yellow; scutellum yellow, with dark areas at its basal corners; mesopleuron yellow with slight dark area anteroventrally; pteropleuron yellow; sternopleuron black, with a narrow yellow band dorsally; femora essentially yellow; tibiae and tarsi brown; squamal fringe dark brown, halteres yellow.

Derivation of the specific name. — The name *balcanicoides* is given in view of the fact that this species belongs to the same group as *L. balcanica* (Strobl).

Geographical distribution. — A male of this species is known only from type locality: CANADA. Alberta: Holotype ♂ St. Albert, near Edmonton, 18.vi.1967.

Liriomyza baptisiae (Frost)

Agromyza baptisiae Frost, 1931:275.

Liriomyza baptisiae (Frost), Frick, 1952:402, 1959:402; Spencer, 1969:169.

Comparisons and diagnostic characters. — The members of this species are small black flies, approximately 1.7 mm in wing length. The adults resemble closely those of *L. quadri-setosa* (Malloch) in external morphology but differ in having only four orbital bristles. The adults differ from those of another similar species, *L. eboni* Spencer, in having all three antennal articles black. Spencer (1969) illustrated the distinctive aedeagus.

Biology. — The larvae form linear blotch mines on leaves of *Baptisia tinctoria* (L.), family Leguminosae, in Pennsylvania, U. S. A. (Frick, 1959). The larvae probably have some other food plant in Alberta.

Geographical distribution. — The members of this species are known from Pennsylvania, U. S. A. (Frick, 1959) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 4 ♂♂, 3 ♀♀ Cypress Hills, near Elkwater Lake, 24.vi.1966.

Liriomyza bifurcata new species

Comparisons. — A member of this species resembles closely that of *L. kenti* Spencer in external characteristics and can be separated reliably only by the examination of male genitalia. It differs from those of similar species, *L. nordica* Spencer and *L. senecionivora* new species, in having two rows of acrostichals and distinct male genitalia. *L. bifurcata* is included in Spencer's (1969) key to the Canadian species of the genus *Liriomyza* Mik as shown at the beginning of the description of *L. senecionivora* new species described later in this treatment.

Description. — Head (Fig 51). Frons wide, approximately two times width of eye at level of front ocellus, slightly projected in front of eye margin in profile; eyes oval, approximately 1.3 times higher than their length; gena approximately one-fifth of eye height midway between vibrissal and posterior margins; ocellar triangle small, lunule almost semicircular above; two strong Ors directed upwards, one Ori directed inwards; orbital setulae three, reclinate; antennal bases approximate; third antennal article rounded at tip, with normal pubescence; arista long and pubescent.

Mesonotum. Dorsocentrals 3+1; acr in two rows.

Wing. Length in male 1.25 mm; costa extended to vein M_{1+2} ; costal segments 2-4 in the

ratio of 1 : 0.4 : 0.24; wing tip at M_{1+2} ; last segment of M_{3+4} approximately three times penultimate.

Male genitalia (Fig. 52-54). Hypandrium U-shaped with slender side arms, pregonites small; postgonites elongated; surstylus small, with a short spine anteriorly and a cone-like projection dorsally on epandrium; aedeagal apodeme lightly sclerotized; phallopore small; basiphallus with a thick swollen ejaculatory duct; hypophallus small narrow process; distiphallus with two divergent tubules distally and small filamentous hair ventrally; ejaculatory apodeme broad, bulb small and sclerotized along the lower margin.

Colour. Frons, orbits, lunule, gena and antennae yellow; ocellar triangle black; vte and vti on dark areas; mesonotum greyish black; humeral area yellow, with dark spot anteriorly; notopleural area yellow; scutellum yellow with lateral dark areas, mesopleuron yellow with small dark area anteroventrally; sternopleuron dark, with narrow yellow band along upper margin; femora yellow, slightly brownish at base; tibiae and tarsi brownish; squamal fringe brown, squamae yellow; halteres yellow.

Derivation of the specific name. — The name *bifurcata* is given in view of two divergent tubular processes on the distiphallus.

Geographical distribution. — A member of this species is known only from the type locality:

CANADA. Alberta: Holotype ♂ Edmonton, White Mud Creek park, 29.vi.1966.

Liromyza conspicua Sehgal

Liromyza conspicua Sehgal, 1968:66.

Diagnostic characters. — The members of this species are large flies, wing length 2.8-3.5 mm, with characteristic prescutellar yellow, yellow third antennal segment, scutellum slightly darkened at basal corners and distinct male genitalia. Sehgal (1968) illustrated the head, wing and male genitalia characteristic of this species.

Geographical distribution. — The members of this species are known from various localities in Alberta, Manitoba, Ontario and Saskatchewan in Canada (Sehgal, 1968). I examined the following further material from Alberta:

CANADA. Alberta: 2 ♂♂, 3 ♀♀ Vègreville, 22.vi.1968.

Liriomyza cordillerana Sehgal

Liriomyza cordillerana Sehgal, 1968:69.

Comparison and diagnostic characters. — The members of this species resemble closely those of *L. septentrionalis* Sehgal in external morphology and can be reliably separated only by the examination of the characters of the male genitalia. The colour of third antennal article is variable from complete yellow to slightly darkened at base of arista; orbits are usually darkened. Sehgal (1968) illustrated the head, wing and the distinctive aedeagus. Spencer (1969) also figured the aedeagus.

Biology. — Larvae mine the leaves of *Deschampsia caespitosa* (L.) Beauv., family Gramineae.

Geographical distribution. — The members of this species are known from various localities in the Rockies in Alberta, Canada (Sehgal, 1968). I examined the following further material from Alberta:

CANADA. Alberta: 1 ♂ Banff, from leaf mine on grass, 13-23.ix.1966; 1 ♂ Blairmore, 26.vi.1966; 1 ♂ Jasper, from leaf mines on *Deschampsia caespitosa* (L.) Beauv., family Gramineae; 1 ♂ same locality, 1.ix.1966.

Liriomyza eboni Spencer

Liriomyza eboni Spencer, 1969:173.

Comparison and diagnostic characters. — The members of this species differ from those of the similar species, *L. baptisiae* (Frost), in having first and second antennal article yellow and acrostichals in two rows. The aedeagus has been illustrated by Spencer (1969).

Geographical distribution. — The members of this species are known only from Alberta, from the type locality:

CANADA. Alberta: Blairmore (Spencer, 1969).

Liriomyza edmontonensis Spencer

Liriomyza edmontonensis Spencer, 1969:174.

Comparison and diagnostic characters. — The members of this species resemble closely those of *L. sylvatica* new species in external morphology and can be reliably separated only by comparison of the characters of male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known from Alberta and British Columbia in Canada. Known Alberta locality is as follows:

CANADA. Alberta: Edmonton, University of Alberta campus (Spencer, 1969).

Liriomyza eupatorii (Kaltenbach)

Agromyza eupatorii Kaltenbach, 1874:320.

Liriomyza eupatorii (Kaltenbach), Hendel, 1920:143; Spencer, 1969:174.

Comparison and diagnostic characters. — The members of this species are very close to those of *L. montana* Sehgal in external characteristics and are reliably separated only by examination of male genitalia. Spencer (1969) figured the distinctive aedeagus of this species. The aedeagus of a caught specimen from Alberta is illustrated in Fig. 55, 56. The distiphallus of this species is very close to that of *L. pictella* (Thompson) and *L. munda* Frick, from which it differs only in minor details. Spencer (1965c) illustrated the aedeagus characteristic of *L. pictella* (Thompson) and of *L. munda* Frick.

Biology. — Larvae mine the leaves of members of the genera *Solidago*, *Helianthus*, *Eupatorium*, *Aster*, and *Lampsana*, family Compositae, and *Galeopsis*, family Labiatae, in Europe (Hering, 1957).

Geographical distribution. — The members of this species are widespread in Europe and are known from Canada (Spencer, 1969). Frick's (1953, 1959) description of *L. eupatorii* (Kaltenbach) refers to *L. munda* Frick (Stegmaier, 1966, 1968). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Edmonton, Aberhart Hospital lawns, 13.vi.1967.

Liriomyza fricki Spencer

Liriomyza trifolii Frick, 1959:410 (not Burgess, 1879).

Liriomyza fricki Spencer, 1965c:35.

Comparison and diagnostic characters. — The members of this species are very close to those of *L. balcanicoides* new species in external characteristics, but the male genitalia are very different. Spencer (1965c, 1969) illustrated the distinctive aedeagus of this species.

Biology. — Larvae mine the leaves of various species of the genera *Medicago*, *Melilotus*,

Trifolium and *Vigna*, of the family Leguminosae (Stegmaier, 1968). The flies were also bred from two other genera *Lathyrus* and *Vicia* of the family Leguminosae. The leaf mine is a small blotch with a short linear beginning.

Geographical distribution. — *L. fricki* Spencer is a Nearctic species whose members are known from Northern United States and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Banff, 28.vi.1966; 1 ♂ Edmonton, 12.vi.1937, coll. E. H. Strickland; 1 ♂, 1 ♀ Elk Island park, from leaf mines on *Trifolium repens* L., coll. 31.vii.1966, emerged 14-15.viii.1966; 2 ♂♂ same locality, from leaf mines on *Vicia americana* Muhl., 31.vii.-11.viii.1966; 1 ♀ same locality, from leaf mines on *Lathyrus ochroleucus* Hook., viii.1967; 5 ♂♂ same locality, 31.vii.1966; 2 ♂♂ same locality, 7.vi. and 2.viii.1966; 2 ♂♂ Jasper, 18.vi. and 23.vii.1966.

Liriomyza kenti Spencer

Liriomyza kenti Spencer, 1969:176.

Comparisons and diagnostic characters. — The members of this species resemble closely those of *L. bifurcata* new species and are separated reliably only by examination of the characters of male genitalia. The adults differ from those of similar species, *L. senecionivora* new species and *L. nordica* Spencer, in having only two rows of acrostichals. Spencer (1969) illustrated the distinctive aedeagus.

Geographical distribution. — The members of this species are known only from the localities of its type series (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Blairmore, 26.vi.1966; 1 ♂ Edmonton, Emily Murphy park, 11.vi.1968; 1 ♂ Edmonton, Mayfair park, 17.v.1969; Paratype 1 ♂ Edmonton, White Mud Creek park, 13.vi.1966; 2 ♂♂ same locality, 19.v.1968; 1 ♂ same locality; 10.vi.1968; 10 ♂♂ same locality, 25.v.1969; 5 ♂♂ Jasper, 19.vi.1966.

Liriomyza lathyri new species

Comparisons. — The members of this species resemble closely those of *L. veluta* Spencer, *L. trifolii* (Burgess) and *L. taraxaci* Hering in external morphology and can be separated reliably only by examination of the characters of the male genitalia. This species is included in Spencer's (1969) key to Canadian species of the genus *Liriomyza* Mik by amending couplet 43 and adding couplet 44 as below:

43	Aedeagus as in Fig. 57, 58	.....	<i>lathyri</i> n. sp.
-	Aedeagus not so	.....	44
44.	Aedeagus as illustrated (Spencer, 1969)	.....	<i>trifolii</i> (Burgess)
-	Aedeagus as illustrated (Spencer, 1969)	.....	<i>veluta</i> Spencer

Description. — Frons approximately 1.8 times width of eye at level of front ocellus, not projected in front of eye margin in profile; eyes oval, approximately 1.25 times higher than their length; gena approximately one-fifth of eye height midway between vibrissal and posterior margins; ocellar triangle small; two Ors directed upwards; two Ori directed inwards; orbits narrow; orbital setulae approximately six, reclinate; third antennal article rounded at tip, with normal pubescence; arista pubescent.

Mesonotum. Dorsocentrals 3+1; acr in three irregular rows.

Wing. Length in male approximately 1.7 mm; costa extended to vein M_{1+2} ; costal segments 2-4 in the ratio of 1 : 0.27 : 0.27; crossvein m-m present; last segment of M_{3+4} approximately 2.5 times the penultimate.

Male genitalia (Fig. 57-59). Hypandrium U-shaped with slender side arms; pregonites broad; postgonites elongated; surstylus typical with a conspicuous spine placed anteriorly; small cone-like projection present on epandrium; phallosome and aedeagus (Fig. 57, 58) as illustrated; ejaculatory apodeme (Fig. 59) broad, darkened at its stem, bulb small, sclerotized along lower margin.

Colour. Frons, orbits, lunule, gena and antennae all yellow or reddish; vte and vti on yellow areas; mesonotum mat greyish black; humeral area yellow, with a dark spot anteriorly; notopleural area yellow; mesopleura essentially yellow, with dark area centrally and along ventral half; sternopleura black, with a narrow yellow band along its dorsal margin, femora essentially yellow; tibiae and tarsi brownish; squamal fringe dark brown; halteres yellow.

Derivation of the specific name. — This species is named *lathyri* after the generic name of its larval food plant.

Biology. — Larvae make large blotch mine with a small linear beginning on the leaflets of *Lathyrus ochroleucus* Hook., family Leguminosae. Pupation occurs outside the mine.

Geographical distribution. — The members of this species are known only from the localities of its type species:

CANADA. Alberta: Holotype ♂ Edmonton, White Mud Creek park, from blotch mines on leaflets of *Lathyrus ochroleucus* Hook., coll. 4.ix.1968, emerged 7.ii.1969; Paratypes 13 ♂♂ Elk Island park, 31.vii.-2.viii.1966.

Liriomyza lima (Melander)

Agromyza lima Melander, 1913:265.

Liriomyza lima (Melander), Frick, 1952:404, 1959:406.

Diagnostic characters. — The main distinguishing characters are mat black mesonotum, yellow femora and third antennal article. The pale squamal fringe differentiates this from other species in this group. Spencer (1969) illustrated the distinctive aedeagus.

Geographical distribution. — Members of this species are known from United States and Canada. The Alberta locality is:

CANADA. Alberta: Edmonton (Spencer, 1969).

Liriomyza millefolii Hering

Liriomyza millefolii Hering, 1927:185; Spencer, 1969:178.

Comparison and diagnostic characters. — The members of this species can be easily recognised by the presence of conspicuously long whitish pubescence on the third antennal article and the presence of vertical bristles on yellow areas. The adults resemble closely those of *L. sinuata* new species in external morphology, but the male genitalia are distinct. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae mine the leaves of *Achillea millefolium* L. and *A. sibirica* Ledeb., family Compositae. Larvae also mine the leaves of *Tanacetum vulgare* L. in the laboratory.

Geographical distribution. — The members of this species are known from Germany (Hendel, 1931) in Europe, and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 2 ♂♂, 3 ♀♀ Edmonton, river bed near University of Alberta campus, from leaf mines on *Achillea sibirica* Ledeb., coll. 26.vii.1966, emerged 10-13.viii.1966; 3 ♂♂, 1 ♀ Edmonton, White Mud Creek park, same host, 6-20.x.1968; 6 ♂♂, 3 ♀♀ Elk Island park, same host, coll. 31.vii.1966, emerged 15-20.viii.1966; 3 ♂♂ same locality, 31.vii.1966; 1 ♀

same locality, viii. 1967

Liriomyza montana Sehgal

Liriomyza montana Sehgal, 1968:67.

Comparison and diagnostic characters. — The members of this species resemble closely those of *L. eupatorii* (Kaltenbach) in external morphology. The position of vertical bristles on yellow areas used to differentiate the adults of this species from those of *L. eupatorii* (Kaltenbach) is variable as the area of vertical bristles in some specimens is darkened. The male genitalia are, however, quite distinct. Sehgal (1968) illustrated the head, wing and male genitalia characteristic of this species. Spencer (1969) also figured the distinctive aedeagus.

Biology. — Larvae probably mine the leaves of grasses (Gramineae).

Geographical distribution. — The members of this species are known from various localities in the Rockies in Alberta, Canada (Sehgal, 1968).

Liriomyza nordica Spencer

Liriomyza nordica Spencer, 1969:179.

Comparisons and diagnostic characters. — The members of this species are very similar to those of *L. senecionivora* new species and differ only in having femora blackish. The male genitalia are, however, very distinct. The adults differ from those of other similar species, *L. bifurcata* new species and *L. kenti* Spencer, in having darker mesopleura and distinct male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known only from the locality of its type series from Canada. I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Edmonton, Rainbow Valley, 31.v.1969; 2 ♂♂ Edmonton, White Mud Creek park, 25.v.1969.

Liriomyza pilosa Spencer

Liriomyza pilosa Spencer, 1969:182.

Comparison and diagnostic characters. — The members of this species resemble closely those of *L. millefolii* Hering in having long pubescence on third antennal article and can be reliably separated only by examination of male genitalia. Surstyli in this species are shorter and broader than in *millefolii* Hering. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — The members of this species are known only from Alberta from the locality of the type specimen as follows:

CANADA. Alberta: Edmonton, University of Alberta campus (Spencer, 1969).

Liriomyza senecionivora new species

Comparisons. — The adults of this species resemble closely those of *L. nordica* Spencer in external characteristics and can be reliably separated only by the examination of male genitalia. *L. senecionivora* and *L. bifurcata* new species described earlier are included in Spencer's (1969) key to Canadian species of the genus *Liriomyza* Mik by amending and extending the couplet 38 as below:

38.	acr in four rows	.....	38a
-	acr in two rows	.....	38b

- 38a. Aedeagus as illustrated (Spencer, 1969) *nordica* Spencer
 - Aedeagus as in Fig. 60, 61. *senecionivora* n. sp.
 38b. Aedeagus as illustrated (Spencer, 1969) *kenti* Spencer
 - Aedeagus as in Fig. 52, 53 *bifurcata* n. sp.

Description. — Head. Frons wide, approximately 1.8 times width of eye at level of front ocellus, slightly projected in front of eye margin in profile; eyes oval, 1.3 times higher than long; gena approximately one-fifth of eye height midway between vibrissal and posterior margins; ocellar triangle small; lunule high, almost flat above; two strong Ors directed upwards, three Ori directed inwards and upwards; orbital setulae few, approximately seven, reclinate; antennal bases approximate; third antennal article rounded at tip, with normal pubescence; arista long and pubescent.

Mesonotum. Dorsocentrals 3+1; acr in four irregular rows.

Wing. Length in male 2.0 mm; costa extended to vein M_{1+2} ; costal segments 2-4 in the ratio of 1 : 0.23 : 0.26; wing tip at vein M_{1+2} ; crossvein m-m present; last segment of M_{3+4} approximately three times penultimate.

Male genitalia (Fig. 60-63). Hypandrium U-shaped with slender side arms; pregonites broad and membranous; postgonites long and narrow; surstyli (Fig. 63) small, with two spines placed anteriorly, small spine on epandrium anteriorly also present; phallopore small and darkly sclerotized; basiphallus and distiphallus lightly sclerotized; ejaculatory duct swollen between basiphallus; distiphallus small; ejaculatory apodeme (Fig. 62) narrow and darkly sclerotized at base, bulb membranous.

Colour. Frons, orbits, lunule, gena and antennae all yellow; ocellar triangle black; vte on black and vti on margin of black and yellow areas; mesonotum mat black; humeral area yellow, with a dark spot anteriorly; notopleural area yellow; scutellum yellow with dark areas at its basal corners; mesopleuron and sternopleuron black with narrow yellow band along upper margins; femora mainly yellow, with slight brownish area towards their base; tibiae and tarsi dark brown; squamal fringe brown, squamae slightly dark; halteres yellow.

Derivation of the specific name. — This species is named *senecionivora* after the name of its food plant.

Biology. — The larvae make linear mines on the leaves of *Senecio pauciflorus* Pursh. Pupation occurs outside the leaf mine.

Geographical distribution. — The members of this species are known only from the type localities:

CANADA. Alberta: Holotype ♂ Jasper National park, near Medicine Lake, from leaf mines on *Senecio pauciflorus* Pursh, coll. 16.vii.1969, emerged 30.vii.1969, coll. G.C. D. Griffiths. Paratype 1 ♂ Blairmore, 26.vi.1966.

Liriomyza septentrionalis Sehgal

Liriomyza septentrionalis Sehgal, 1968:70.

Comparison and diagnostic characters. — The members of this species resemble closely those of *L. cordillerana* Sehgal in external morphology, and can be reliably separated only by the examination of the characters of male genitalia.

The third antennal article is variable in colour from complete yellow to slightly darkened at the base of arista; orbits are usually yellow. Sehgal (1968) figured the head, wing and the characteristic aedeagus.

Biology. — Larvae mine the leaves of grasses (Gramineae).

Geographical distribution. — The members of this species are known from various localities in the Rocky Mountains and Cypress Hills in Alberta and from British Columbia (Sehgal,

1968).

Liriomyza singula Spencer

Liriomyza singula Spencer, 1969:184.

Diagnostic characters. — The members of this species are distinct in the absence of cross-vein m-m; the third antennal article is only lightly darkened at the base of arista. Spencer (1969) figured the distinctive aedeagus.

Geographical distribution. — The members of this species are known only from its type species in Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: Paratype 1 ♂ Blairmore, 20.vi.1966.

Liriomyza sinuata new species

Comparisons. — The members of this species resemble those of *L. millefolii* Hering in having long pubescence on third antennal article but differ in having both vertical bristles on dark areas and distinct male genitalia. This species is included in Spencer's (1969) key to Canadian species of the genus *Liriomyza* Mik by amending and extending the couplet 26 as below:

- 26. Orbits shining black; mesopleura black in lower three-quarters; femora distinctly darkened sp. (Constance Bay)
- Orbits yellow; femora yellow 26a
- 26a. vte on black and vti on margin of black and yellow ground *sinuata* n. sp.
- Both vt on yellow ground. 27

Description. — Head. Frons wide, approximately twice width of eye at level of front ocellus, projected in front of eye margin in profile; eyes oval, slightly slanted, 1.25 times higher than their length; gena deep, approximately one-third of eye height midway between vibrissal and posterior margins; ocellar triangle small; lunule high, narrow at top; two strong Ors directed upwards; two Ori, lower one directed inwards and upper one directed upwards; orbital setulae one to two, reclinate; antennal bases approximate; third antennal article rounded at tip, with conspicuous pubescence; arista pubescent.

Mesonotum. Dorsocentrals 3+1; acr in two rows.

Wing. Length in male approximately 1.5 mm; costa extended to vein M_{1+2} ; costal segments 2-4 in the ratio of 1 : 0.35 : 0.25; wing tip at M_{1+2} ; crossvein m-m present; last segment of M_{3+4} approximately 2.5 times penultimate.

Male genitalia (Fig. 64-67). Hypandrium U-shaped with slender side arms; pregonites broad; postgonites elongated; surstylus (Fig. 67) small with short spine anteriorly and small spine dorsally on epandrium; aedeagal apodeme darkly sclerotized; phallopore small; ejaculatory duct swollen between basiphallus; distiphallus two long tubular S-shaped processes; ejaculatory apodeme (Fig. 66) broad, bulb small and sclerotized along lower margin.

Colour. Frons, orbits, lunule, gena and antennae all yellow; vte on black and vti on the margin of dark and yellow areas; mesonotum mat black; humeral area yellow, with a dark spot anteriorly; notopleural area yellow; scutellum yellow, with dark area along its basal corners; mesopleuron yellow with slight dark area anteroventrally; sternopleuron black, with a narrow yellow band dorsally; femora mainly yellow; tibiae and tarsi brown, squamal fringe dark brown; halteres yellow.

Derivation of the specific name. — The name *sinuata* is given in view of the sinuate or wavy distiphallus.

Geographical distribution. — The members of this species are known only from the locali-

ties of its type specimens:

CANADA. Alberta: Holotype ♂ Banff, 28.vi.1966; Paratype 1 ♂ Cypress Hills, Elkwater, 24.vi.1966.

Liriomyza smilacinae Spencer

Liriomyza smilacinae Spencer, 1969:186.

Comparison and diagnostic characters. — The members of this species are close to those of *L. undulata* Spencer in external morphology and are separated only by examination of the characters of male genitalia. Spencer (1969) illustrated the characteristic aedeagus.

Biology. — Larvae form linear leaf mines on the leaves of *Smilacina stellata* (L.) Desf., family Liliaceae. Spencer (1969) illustrated the leaf mine characteristic of this species.

Geographical distribution. — The members of this species are known only from the localities of its type series in Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: Paratype 1 ♂ Edmonton, White Mud Creek park, 13.vi.1966; 1 ♂ same locality, 18.vi.1968, leg. G. C. D. Griffiths; 4 ♂♂, 5 ♀♀ same locality, from leaf mines on *Smilacina stellata* (L.) Desf., coll. 10.vi.1968, leg. G. C. D. Griffiths; 1 ♂ same locality and host, 10.vi.1968-2.ii.1969; 1 ♂, 1 ♀ same locality and host, 28.vi.-14.vii.1968.

Liriomyza socialis Spencer

Liriomyza socialis Spencer, 1969:186.

Diagnostic characters. — The main distinguishing characters of the members of this species are mat grey mesonotum and two rows of acrostichals. The colour of third antennal article varies from pale to dark brown (Spencer, 1969). Spencer (1969) illustrated the distinctive aedeagus.

Geographical distribution. — The members of this species are known only from Alberta, Canada. The Alberta localities are as follows:

CANADA. Alberta: Blairmore, Elk Island park, Jasper (Spencer, 1969).

Liriomyza sylvatica new species

Comparisons. — A male of this species is very similar to that of *L. edmontonensis* Spencer in external characteristics and is reliably separated only by examination of male genitalia, which, however, are very distinct. This species is included in Spencer's (1969) key to Canadian *Liriomyza* species by amending and extending the couplet 37 as below:

- | | | | |
|------|---|-------|------------------------------|
| 37. | Femora partially darkened | ..... | 37a |
| - | Femora almost entirely bright yellow | ..... | <i>arctica</i> Spencer |
| 37a. | Aedeagus as illustrated (Spencer, 1969) | ..... | <i>edmontonensis</i> Spencer |
| - | Aedeagus as in Fig. 68, 69 | ..... | <i>sylvatica</i> n. sp. |

Description. — Head. Frons approximately 1.3 times wider than the width of eye at level of front ocellus; slightly projected in front of eye margin in profile; eyes oval, 1.4 times higher than their length; gena little less than one-fourth of eye height midway between vibrissal and posterior margins; ocellar triangle small; lunule high; two Ors directed upwards; two Ori directed inwards and upwards; orbital setulae three to four, reclinate; antennal bases approximate; third antennal article with a slight angle anterodorsally, with normal pubescence; arista pubescent.

Mesonotum. Dorsocentrals 3+1; acr in four irregular rows.

Wing. Length in male 1.7 mm; costa extended to vein M_{1+2} ; costal segments 2-4 in the ratio of 1 : 0.26 : 0.18; wing tip at vein M_{1+2} ; crossvein m-m present; last segment of M_{3+4} approximately three and a half times the penultimate.

Male genitalia. (Fig. 68, 69). Hypandrium U-shaped with slender side arms; pregonites broad; postgonites elongated; surstylus small and lightly sclerotized; aedeagal apodeme darkly sclerotized; phallopore elongate; ejaculatory duct swollen between basiphallus; distiphallus as illustrated; ejaculatory apodeme broad, bulb small and sclerotized along lower margin.

Colour. Frons, gena, lunule and antennae yellow; upper orbits partially darkened up to lower Ors; vte on black and vti on the margin of dark and yellow areas; mesonotum mat greyish black; humeral area yellow, with a dark spot anteriorly; notopleural area yellow; scutellum yellow, with slight dark at its basal corners; mesopleuron black with a narrow yellow band dorsally; sternopleuron black; femora yellow, darkened towards base, tibiae and tarsi dark brown; squamal fringe brownish; halteres yellow.

Derivation of the specific name. — The name *sylvatica* indicates that the species is woodland-inhabiting.

Geographical distribution. — This species is known only from the type locality: CANADA. Alberta: Holotype ♂ St. Albert, near Edmonton, 18.vi.1967.

Liriomyza taraxaci Hering

Liriomyza taraxaci Hering, 1927:184; Spencer, 1969:188.

Comparisons and diagnostic characters. — The members of this species resemble closely those of *L. veluta* Spencer, *L. trifolii* (Burgess), *L. lathyri* new species, and differ only in having mesonotum black and not grey. The male genitalia are, however, entirely different. Spencer (1969) illustrated the aedeagus distinctive of this species.

Biology. — Larvae form elongate blotch mines on the leaves of *Taraxacum officinale* Weber, family Compositae. Hering (1927) illustrated the characteristic leaf mine.

Geographical distribution. — The members of this species are known from various localities in Europe (Hendel, 1931) and from Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Banff, 28.vi.1966; 1 ♂ Blairmore, 26.vi.1966; 1 ♀ Edmonton, 110 Street, 84 Avenue, from leaf mines on *Taraxacum officinale* Weber, 15-29.vi.1968; 2 ♂♂ Edmonton, University of Alberta campus, same host, 27.vii.-11.viii.1966; 1 ♂ Edmonton, White Mud Creek park, 28.v.1967.

Liriomyza undulata Spencer

Liriomyza undulata Spencer, 1969:190

Comparison and diagnostic characters. — The members of this species resemble closely those of *L. smilacinae* Spencer in external morphology, but have distinct male genitalia. Spencer (1969) illustrated the characteristic aedeagus. The distiphallus is distinctive in having a long undulating process distally.

Geographical distribution. — The members of this species are known only from the localities of its type series from Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 2 ♂♂ Blairmore, 26.vi.1966; Paratype 1 ♂ Edmonton, White Mud Creek park, 23.vi.1966, coll. V. K. Sehgal, 11 ♂♂ same locality, 23-29.vi.1966.

Liriomyza veluta Spencer

Liriomyza veluta Spencer, 1969:190.

Comparisons and diagnostic characters. — The members of this species resemble closely those of *L. lathyri* new species and *L. trifolii* (Burgess) in external morphology and can be separated only by examination of the characters of male genitalia. The adults differ from those of another similar species, *L. taraxaci* Hering, in having mesonotum grey and not black. Spencer (1969) illustrated the distinctive aedeagus.

Geographical distribution. — The members of this species are known from various localities of its type series from Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Blairmore, 26.vi.1966; 1 ♂ Edmonton, White Mud Creek park, viii.1968; 2 ♂♂, 1 ♀ George Lake, near Busby, 21.vi.1966.

Liriomyza viciae Spencer

Liriomyza viciae Spencer, 1969:191.

Comparison and diagnostic characters. — The members of this species resemble closely those of *L. melampyga* (Loew) in external morphology and differ only in having acrostichals in two rows and distinctive male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species as well as that of *L. melampyga* (Loew).

The adults are small flies, wing length approximately 2.0 mm, with characteristic prescutellar yellow and yellow antennae.

Biology. — Larvae form blotch mines on the leaflets of *Vicia americana* Muhl., family Leguminosae.

Geographical distribution. — The members of this species are known only from the type series from Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♀ Banff, 28.vi.1966; Paratype 1 ♂ Blairmore, 27.vi.1966; 1 ♀ Edmonton, University of Alberta campus, from leaf mines on *Vicia americana* Muhl., 21.ix.1968-13.ii.1969; 1 ♂ Elk Island park, 31.vii.1966; 3 ♀♀ Jasper, 17-23.vi.1966.

Genus *Lemurimyza* Spencer

Lemurimyza Spencer, 1965b:26.

The main distinguishing characters of the genus *Lemurimyza* Spencer are: subcosta weakly developed distally, joined to costa independent of R_1 ; costa extended to vein M_{1+2} ; orbital setulae normally erect or slightly proclinate; scutellum yellow; mesonotum with yellow central area adjoining scutellum, epandrium normally with comb-like arrangement of dark spines; aedeagus typical of the genus, with paired sclerotized tubules.

The genus *Lemurimyza* Spencer is represented in Alberta by only one species, *L. pallida* Sehgal. The members of this genus are extremely similar to those of the genus *Liriomyza* Mik in external characteristics, but possess very distinct male genitalia.

Lemurimyza pallida Sehgal

Lemurimyza pallida Sehgal, 1968:72.

Comparisons and diagnostic characters. — The members of this species differ from those of two other species, *L. dorsata* (Siebke) and *L. pacifica* (Melander), known from Canada (Spencer, 1969), in having third antennal article yellow and distinctive male genitalia. Sehgal

(1968) illustrated the head, wing and male genitalia characteristic of this species. Spencer (1969) also illustrated the aedeagus.

Geographical distribution. — The members of this species are known only from the type locality as follows:

CANADA. Alberta: Banff (Sehgal, 1968).

Genus *Metopomyza* Enderlein

Metopomyza Enderlein, 1936:180.

The main distinguishing characters of this genus are subcosta fold-like distally and joined to costa independent of R_1 ; orbital setulae reclinate; costa extended to apex of vein M_{1+2} ; scutellum yellow; orbits broad and raised above plane of frons; aedeagus typical of genus.

The members of this genus are very similar to those of the genus *Liriomyza* Mik in external morphology, but the male genitalia are very distinct.

This genus is represented in Alberta by two species, *interfrontalis* (Melander) and *griffithsi* new species.

Key to Alberta species of the genus *Metopomyza* Enderlein

1. Squamal fringe yellow; larger specimens, wing length 2.0-2.3 mm *interfrontalis* (Melander), p. 343
- Squamal fringe brown, smaller specimens, wing length 1.5 mm in male *griffithsi* n. sp., p. 342

Metopomyza griffithsi new species

Comparisons and diagnostic characters. — A member of this species differs from that of *interfrontalis* (Melander) in having smaller size and brown squamal fringe. It resembles that of a Palearctic species, *flavonotata* (Haliday), but possesses distinct male genitalia. This species is distinguished in Spencer's (1969) key to Canadian species of the genus *Metopomyza* Enderlein by amending and extending the couplet 1 as below:

1. Notopleural area black 1a
- Notopleural area yellow 2
- 1a. Larger specimens, wing length 2.0-2.3 mm; squamal fringe yellow *interfrontalis* (Melander)
- Smaller specimens, wing length 1.5 mm in male; squamal fringe brown *griffithsi* n. sp.

Description. — Head. Frons approximately 1.8 times width of eye at level of front ocellus, slightly projected in front of eye margin in profile; orbits broad, slightly raised above the plane of frons; eyes oval, strongly slanted along posteroventral margin, vertical height is almost equal to their length; ocellar triangle small; gena deep, approximately 0.3 times vertical height of eye. Two strong Ors directed upwards; two strong Ori directed inwards; orbital setulae numerous, reclinate; third antennal article slightly angulate antero-dorsally and rounded below, pubescent.

Mesonotum. Dorsocentrals 3+1 decreased in length anteriorly, acr in three to four irregular rows.

Wing. Length in male 1.5 mm; costa extended to vein M_{1+2} ; costal segments 2-4 in ratio of 1 : 0.33 : 0.26; vein M_{1+2} at the wing tip; crossvein m-m present; last segment of M_{3+4} approximately 0.4 times penultimate.

Male genitalia (Fig. 70-72). Hypandrium with narrow side arms; surstyli (Fig. 70) with

two rows of conspicuous spines as illustrated; phallopore long; aedeagus (Fig. 71) typical of genus; basiphallus broad and sclerotized; mesophallus long and slender; distiphallus as small divergent tubules distally; ejaculatory apodeme (Fig. 72) small and narrow, bulb small, membranous.

Colour. Frons darker below and yellowish above, orbits black; lunule dark; gena greyish black; antennae black; mesonotum mat black, slightly brownish; scutellum almost entirely yellow; mesopleura, sternopleura and pteropleura all black; femora black, with distal tips yellow; tibiae and tarsi brownish black; squamae pale, fringe brownish; halteres yellow.

Derivation of the specific name. — This species is named in honour of G. C. D. Griffiths of the Department of Entomology, University of Alberta, Canada.

Geographical distribution. — A member of this species is known only from the type locality:

CANADA. Alberta: Holotype ♂ Edmonton, White Mud Creek park, 18.vi.1968, coll. G. C. D. Griffiths.

Metopomyza interfrontalis (Melander)

Agromyza interfrontalis Melander, 1913:263.

Liriomyza interfrontalis (Melander), Frick, 1952:403.

Metopomyza interfrontalis (Melander), Frick, 1957:204, 1959:412; Spencer, 1969:198.

Comparison and diagnostic characters. — The members of this species differ from those of *griffithsi* new species in having larger size and pale squamal fringe. Spencer (1969) illustrated the distinctive aedeagus.

Geographical distribution. — The members of this species are known from Canada and United States. The Alberta locality is:

CANADA. Alberta: Elkwater (Spencer, 1969).

Genus *Praspedomyza* Hendel

Dizygomyza (Praspedomyza) Hendel, 1931:77.

Phytobia (Praspedomyza) Frick, 1952:395, 1959:394.

Praspedomyza Hendel, Spencer, 1966b:146.

Nowakowski (1962) on the basis of his studies on male genitalia proposed that this genus should be merged with the genus *Liriomyza* Mik. Later Spencer (1966b, 1969) in view of the dark colouration, raised orbits and distinct male genitalia justified the retention of *Praspedomyza* Hendel as a distinct genus.

This genus is represented in Canada by only one species, *galiivora* Spencer, the common leaf miner on *Galium*.

Praspedomyza galiivora Spencer

Praspedomyza galiivora Spencer, 1969:199.

Diagnostic characters. — The members of this species are quite distinctive in having yellow third antennal article and distinct male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species. The colour of third antennal article varies slightly from bright yellow to reddish.

Biology. — Larvae mine the leaves of *Galium boreale* L., family Rubiaceae.

Geographical distribution. — The members of this species are known from Europe and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Banff, 28.vi.1966; 1 ♂, 3 ♀♀ Edmonton, White Mud Creek park, 13-23.vi.1966; 3 ♀♀ same locality, from leaf mines on *Galium boreale* L., coll. 28.vi.1968, emerged 11-12.vii.1968; 1 ♂ same locality and host, coll. 4.ix.1968, emerged 16.ix.1968, coll. G. C. D. Griffiths; 1 ♂ Edmonton river bank near University of Alberta campus, 14.vi.1969; 4 ♂♂, 1 ♀ Elk Island park, 31.vii.-2.viii.1966.

Genus *Haplomyza* Hendel

Antineura Melander, 1912:219.

Haplomyza Hendel, 1914:73, new name for *Antineura* Melander, not Osten Sacken 1881.

The members of this genus resemble externally those of the large genus *Liriomyza*, but possess distinct male genitalia. They are represented in Alberta by only one species, *togata* (Melander).

Haplomyza togata (Melander)

Antineura togata Melander, 1913:250.

Haplomyza togata (Melander); Frick, 1953:73, 1959:413; Spencer, 1969:201.

Diagnostic characters. — The main distinguishing characters of the members of this species are wing length 1.75-2.2 mm, costa extended to vein M_{1+2} ; crossvein m-m absent; one Ors and three Ori; eyes slanted; frons, gena, face and antennae yellow; mesonotum mat grey, few acrostichals and distinct male genitalia. The ninth sternite is greatly elongate.

Biology. — Larvae are known to make irregular blotch mines on the leaves of *Amaranthus* spp., family Amaranthaceae, in United States (Frick, 1959).

Geographical distribution. — The members of this species are known from United States, and Alberta and Saskatchewan in Canada (Spencer, 1969). The Alberta locality is:

CANADA. Alberta: Drumheller.

Genus *Phytoliriomyza* Hendel

Liriomyza (*Phytoliriomyza*) Hendel, 1921:203.

Phytoliriomyza Hendel; Frey, 1941:19; Frick, 1952:410; Spencer, 1964b:662.

Xyraeomyia Frick, Spencer, 1964b:662.

The members of this genus differ from those of the genus *Liriomyza* Mik in having dark scutellum and proclinate orbital setulae. They are represented in Alberta by only one species, *arctica* (Lundbeck).

Phytoliriomyza arctica (Lundbeck)

Agromyza arctica Lundbeck, 1900:304.

Odinia immaculata Coquillett, 1902:185.

Agromyza formosensis Malloch, 1914b:315.

Dizygomyza (*Icteromyza*) *arctica* (Lundbeck), Hendel, 1931:57.

Phytoliriomyza arctica (Lundbeck); Shewell, 1953:469; Frick, 1959:414.

Diagnostic characters. — The main distinguishing characters of the members of this species are: eyes oval, slanted, slightly pilose; acrostichals present; wing length approximately 2.0 mm; costa strongly extended to vein M_{1+2} ; crossvein m-m present; and aedeagus with characteristic two long, membranous coiled tubules. Spencer (1963, 1964b, 1969) discussed in detail and illustrated the male genitalia of members of this species.

Biology. — Larvae feed as stem miners on *Sonchus asper* L., family Compositae in Germany (Spencer, 1963). No host plant is yet known in North America.

Geographical distribution. — The members of this species are most widely distributed being known from Europe, Formosa, Canada, United States and South America (Spencer, 1963). I examined the following material from Alberta:

CANADA. Alberta: 4 ♂♂ Cypress Hills, near Elkwater Lake, 24.vi.1966.

Genus *Pseudonapomyza* Hendel

Pseudonapomyza Hendel, 1920:115.

The members of this genus differ from those in the genus *Phytomyza* Fallén in having crossvein m-m basal to r-m and reclinate orbital setulae. They are represented in Alberta by two species, *atra* (Meigen) and *lacteipennis* (Malloch).

Key to Alberta species of the genus *Pseudonapomyza* Hendel

1. Mesonotum weakly shining black; tarsi dark brown; wings normal *atra* (Meigen), p. 345
- *lacteipennis* (Malloch), p. 345

Pseudonapomyza atra (Meigen)

Phytomyza atra Meigen, 1830:191.

Pseudonapomyza atra (Meigen); Hendel, 1932:302; Spencer, 1969:209.

Comparison and diagnostic characters. — The members of this species are quite distinctive in having angulate third antennal articles. The adults differ from those of similar species, *P. lacteipennis* (Malloch), in having dark tarsi and weakly shining black mesonotum.

Biology. — Larvae mine the leaves of grasses (Gramineae).

Geographical distribution. — The members of this species are Holarctic in distribution, known from Europe (Hendel, 1932), United States (Frick, 1959) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♀ Edmonton, 26.v.1946, coll. W. R. M. Mason; 1 ♀ Edmonton, University of Alberta campus from leaf mine on grass; coll. 22.vi.1968, emerged 12.vii.1968.

Pseudonapomyza lacteipennis (Malloch)

Phytomyza lacteipennis Malloch, 1913b:152.

Pseudonapomyza lacteipennis (Malloch); Frick, 1952:419, 1959:419; Spencer, 1969:210.

Diagnostic characters. — The main distinguishing characters are mat greyish mesonotum, yellow tarsi and whitish wings.

Biology. — Larvae probably mine the leaves of grasses (Gramineae).

Geographical distribution. — The members of this species are known from United States and Canada. The Alberta localities are as follows:

CANADA. Alberta: Elkwater; Medicine Hat; Orion (Spencer, 1969).

Genus *Paraphytomyza* Enderlein

Paraphytomyza Enderlein, 1936:180; Nowakowski, 1962:102; Spencer, 1969:203.

Rubiomyza Nowakowski, 1962:102.

The name *Phytagromyza* Hendel which has long been used (Hendel, 1920, 1932; Frick,

1952, 1959) for members of this genus, cannot be used now as its type, *P. flavocingulata* (Strobl), is now referred to the genus *Cerodontha* Rondani (Nowakowski, 1962, 1967).

The main distinguishing characters of the genus *Paraphytomyza* Enderlein are: subcosta weakly developed distally, joined to costa independent of R_1 ; orbital setulae erect or reclinate or absent; costa extended to vein R_{4+5} ; crossvein m-m usually absent, if present, always beyond crossvein r-m.

This genus is represented in Alberta by five species. All Alberta species discussed here probably form a single group within the genus *Paraphytomyza* Enderlein, whose members feed on the representatives of the family Caprifoliaceae and other related families of the order Rubiales. Nowakowski (1962) proposed a new genus, *Rubiomyza*, for this group of flies. The name proved to be synonymous with *Paraphytomyza* Enderlein.

Another group of leaf miners on Salicaceae is probably also represented in Alberta. Linear leaf mines on the under surface of the leaves of *Populus tremuloides* Michx., quite common around Edmonton, are very similar to those of *Paraphytomyza tremulae* (Hering) in Europe on *Populus tremula* L. Since no flies have yet been bred, their identity cannot be confirmed.

Key to Alberta species of the genus *Paraphytomyza* Enderlein

- 1(0). Crossvein m-m present 2
- Crossvein m-m absent 4
- 2(1). Dorsocentrals two; mouthparts elongate *nitida* (Malloch), p. 347
- Dorsocentrals three or more; mouthparts normal. 3
- 3(2). Notopleural area yellow *plagiata* (Melander), p. 347
- Notopleural area brownish black *loniceræ* (Robineau-Desvoidy), p. 346
- 4(1). Small specimens, wing length 1.6-1.8 mm in males; aedeagus as illustrated (Fig. 76) *spenceri* n. sp., p. 348
- Larger specimens, wing length 2.0 to 2.4 mm *orbitalis* (Melander), p. 347

Paraphytomyza loniceræ (Robineau-Desvoidy)

Phytomyza loniceræ Robineau-Desvoidy, 1851:396.

Phytagomyza loniceræ (Robineau-Desvoidy); Hering, 1951:36; Frick, 1953:74.

Paraphytomyza loniceræ (Robineau-Desvoidy); Spencer, 1969:205.

Comparison and diagnostic characters. — The members of this species are very close to those of *P. orbitalis* (Melander) in the general shape of aedeagus, but differ in lacking crossvein m-m. Spencer (1969) illustrated the aedeagus characteristic of this species. The posterior spiracles of the puparium are distinctive in having a dark spine in centre.

Biology. — Larvae mine the leaves of various members of the genera *Lonicera* and *Symphoricarpos*, family Caprifoliaceae. Frick (1953) reared this species from *Lonicera involucrata* (Richards) Banks and *Symphoricarpos albus* (L.). I observed the leaf mines of this species in Alberta on *Lonicera dioica* L., *L. tartarica* L. and *Symphoricarpos albus* (L.). The leaf mine is whitish, linear with distinct frass granules disposed alternately along the mine. Hering (1951) illustrated the characteristic leaf mine. This species is the first to appear in early spring and there is only one generation a year.

Geographical distribution. — The members of this species are known from Europe, United States and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 2 ♂♂ Edmonton, White Mud Creek park, 19.v.1968; 2 ♂♂ same locality, 7.v.1969.

Paraphytomyza nitida (Malloch)

Agromyza nitida Malloch, 1913a:288; Frick, 1952:373.

Phytomyza nitida (Malloch); Frick, 1953:74, 1959:417.

Paraphytomyza nitida (Malloch); Spencer, 1969:207.

Diagnostic characters. — The members of this species are distinctive in having elongate mouthparts and absence of crossvein m-m. Spencer (1969) illustrated the distinctive aedeagus.

Biology. — Not confirmed. Spencer (1969) noted the similarity between this species and *P. orphana* (Hendel), a stem miner on *Galium* in Europe, and has suggested as host one of the *Galium* species occurring in Alberta.

Geographical distribution. — The members of this species are known from United States (Frick, 1953, 1959) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♀ Elk Island park, 7.vi.1966.

Paraphytomyza orbitalis (Melander)

Phytomyza orbitalis Melander, 1913:271.

Phytomyza orbitalis (Melander); Frick, 1952:416, 1959:417.

Paraphytomyza orbitalis (Melander); Spencer, 1969:207.

Comparison and diagnostic characters. — The members of this species resemble externally those of a sympatric species, *P. spenceri* new species, but differ in having a distinct aedeagus and larval leaf mine (Fig. 73). The aedeagus has been illustrated by Spencer (1969). The females unless represented by bred series cannot be determined definitely.

Biology. — Larvae mine the leaves of *Lonicera dioica* L. and *Symphoricarpos albus* (L.), family Caprifoliaceae. The leaf mine (Fig. 73) is broad, linear in shape. Pupation occurs outside the leaf mine.

Geographical distribution. — *P. orbitalis* (Melander) is a Nearctic species, whose members are known from United States (Frick, 1952, 1959) and Canada (Spencer, 1969). I examined 10 males and one female from Alberta:

CANADA. Alberta: 1 ♂ Blairmore, 27.vi.1966; 1 ♂ Edmonton, 24.v.1946, coll. E. H. Strickland; 1 ♂ Edmonton, University of Alberta campus, from leaf mines on *Lonicera dioica* L., 29.v.-22.vi.1966; 1 ♀ Edmonton, White Mud Creek park from leaf mines on *Symphoricarpos albus* (L.), coll. 10.vi.1966; 3 ♂♂ same locality, 12-19.vi.1966; 2 ♂♂ same locality, 15.vii.1966; 1 ♂ Edmonton, Mayfair park, 4.v.1969; 1 ♂ Elk Island park, 4.vi.1967; 1 ♂ St. Albert, near Edmonton, 14.vi.1966.

Paraphytomyza plagiata (Melander)

Napomyza plagiata Melander, 1913:273.

Agromyza plagiata (Melander); Malloch, 1918:130.

Phytomyza plagiata (Melander); Frick, 1952:416, 1959:417.

Paraphytomyza plagiata (Melander); Spencer, 1969:208.

Diagnostic characters. — The members of this species can be easily recognised by the characters given in the key.

Biology. — Larvae mine the leaves of *Lonicera involucrata* (Richards) Banks, family Caprifoliaceae. The leaf mine (Fig. 74) is linear and light greenish in colour.

Geographical distribution. — The members of this species are known from United States

(Frick, 1952) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ George Lake, near Busby, from leaf mines on *Lonicera involu-crata* (Richards) Banks, 7.vi.1968 emerged 30.iv.1969, coll. G. C. D. Griffiths; 1 ♀ St. Albert, near Edmonton, same host, 14.vi.1966-5.iii.1967; 1 ♀ same locality, 14.vi.1966.

Paraphytomyza spenceri new species

Comparisons and diagnostic characters. — The members of this species resemble externally those of a sympatric species, *P. orbitalis* (Melander), and can only be reliably differentiated by the examination of the male genitalia. The females unless from bred series are very difficult to determine definitely. The linear leaf mine of this species (Fig. 79) is similar to that of *P. luteoscutellata* (de Meijere) illustrated by Spencer (1969), but the adults are distinct in having completely black scutellum. This species is distinguished in Spencer's (1969) key to Canadian species of the genus *Paraphytomyza* Enderlein by extending the couplet 5 as below:

5. Scutellum yellow, at least between basal scutellar bristles
 *luteoscutellata* (de Meijere)
 - Scutellum entirely dark 5a
 5a. Wing length up to 2.0 mm; aedeagus as in Fig. 76 *spenceri* n. sp.
 - Larger specimens 6

Description. — Head (Fig. 75). Frons almost equal to width of eye at level of front ocellus; upper orbits slightly projected in front of eye margin in profile; eyes oval, 1.3 times higher than their width, bare; ocellar triangle small; gena deepest posteriorly, approximately one-sixth of eye height mid-way between vibrissal and posterior margins; two strong Ors directed upwards; two Ori directed inwards; orbital setulae 4-6, reclinate; third antennal article rounded at tip, arista long and pubescent.

Mesonotum. Dorsocentrals 3+1; acr numerous in approximately four rows.

Leg. Mid-tibia without a differentiated bristle medially.

Wing. Length in ♂♂ 1.6-1.8 mm, in ♀♀ approximately 2.0 mm; costa extended to vein R_{4+5} ; wing tip between R_{4+5} and M_{1+2} ; crossvein m-m absent; costal segments 2-4 in the ratio of 1.0 : 0.23 : 0.28.

Male genitalia (Fig. 76). Hypandrium U-shaped with slender side arms and no apodeme; surstyli broad and rounded, without spines; pregonites broad; postgonites elongate; phallosophore short and darkly sclerotized; basiphallus a pair of broad arms; distiphallus removed from basiphallus by a short membranous gap, of two distinctive curved tubes; aedeagal apodeme weakly sclerotized; ejaculatory apodeme small and fan-shaped, bulb small and membranous.

Colour. Frons darker above the lunule; orbits yellow; ocellar triangle black; antennae, gena and lunule yellowish brown; mesonotum and scutellum mat grayish black; humeral and notopleural areas yellow; femora dark brown; tibiae and tarsi mostly yellowish or slightly brownish; squamae yellow, fringe slightly brownish; halteres yellow.

Description of immature stages. — Puparium brownish yellow, oval and deeply segmented, measures approximately 1.5 mm x 0.8 mm.

Larval mouth parts obtained from puparium are illustrated (Fig. 77). Right mandible larger than left, each with two distinct teeth alternate with one another; labial sclerite short and darkly sclerotized; paraclypeal phragmata with darkly sclerotized dorsal and weakly sclerotized ventral arms.

Muscle scars on abdominal segments small and oval; tubercles numerous in approximately six to eight rows.

Anterior spiracles small, each with about six to eight bulbs; posterior spiracles (Fig. 78) small and rounded, each with 11-12 bulbs.

Derivation of the specific name. — This species is named in honour of Dr. K. A. Spencer, who has contributed greatly to the knowledge of world Agromyzidae.

Biology. — Larvae mine the leaves of *Lonicera dioica* L. and *Symphoricarpos occidentalis* Hook., family Caprifoliaceae. The leaf mine (Fig. 79) is linear, greenish black, without discrete frass granules. Pupation occurs outside the mine.

Geographical distribution. — I examined the members of this species only from the province of Alberta.

CANADA. Alberta: Holotype ♂ Edmonton, White Mud Creek park, from leaf mine on *Lonicera dioica* L., 21.ix.-10.x.1968; allotype ♀ same locality and host, 21.ix.-22.x.1968; paratypes 2 ♀♀ same locality and host, 21.ix.-10.x.1968; 1 ♂ same locality and host, 6.ix.1968-7.ii.1969; 1 ♀ same locality and host, 6.ix.-22.x.1968; 1 ♂, 1 ♀ same locality and host, coll. 6.ix.1968, emerged 2.vi.1969; 2 ♂♂ same locality, from leaf mines on *Symphoricarpos occidentalis* Hook., coll. 10.ix.1966, emerged 25.iii.1967 and 2.vi.1967; 4 ♂♂ same locality, 6-23.vi.1966; 1 ♂ same locality, 8.vi.1967; 2 ♂♂ Edmonton, Mayfair park, 17.v.1969; 1 ♂ Drumheller, 14.vi.1946, coll. W. R. M. Mason.

Genus *Napomyza* Westwood

Napomyza Westwood, 1840:152

The members of this genus differ from those in the large genus *Phytomyza* Fallén in the presence of crossvein m-m. Male genitalia are, however, distinct. This genus is represented in Alberta by three species.

Key to Alberta species of the genus *Napomyza* Westwood

- 1(0). Third antennal article with conspicuous pubescence *plumea* Spencer, p. 350
 - Third antennal article almost bare 2
 2(1). Smaller specimens, wing length about 2.5-3.1 mm; distiphallus paler
 *nugax* Spencer, p. 349
 - Larger specimens, wing length about 3.5-4.5 mm; distiphallus darkly sclerotized
 *immanis* Spencer, p. 349

Napomyza immanis Spencer

Napomyza immanis Spencer, 1969:215.

Comparison and diagnostic characters. — The members of this species differ from those of a similar species, *nugax* Spencer, in larger size, wing length 3.5-4.5 mm; third antennal article slightly less quadrate and aedeagus with darker distiphallus. Spencer (1969) illustrated the distinctive aedeagus.

Geographical distribution. — Known from Alaska, Alberta, Northwest Territories and Yukon Territory. The Alberta locality is as follows:

CANADA. Alberta: Edmonton, White Mud Creek park (Spencer, 1969).

Napomyza nugax Spencer

Napomyza nugax Spencer, 1969:215.

Comparison and diagnostic characters. — The members of this species differ from those of a similar species, *immanis* Spencer, in having smaller size, wing length 2.5-3.1 mm; quadrate third antennal article and paler distal process on the distiphallus. Spencer (1969) illustrated the distinctive aedeagus. They also differ from *lateralis* (Fallén) in having distinct aedeagus.

Geographical distribution. — Known from Alberta, British Columbia, Ontario and Quebec in Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂, 1 ♀ Blairmore, 26.vi.1966.

Napomyza plumea Spencer

Napomyza plumea Spencer, 1969:217.

Diagnostic characters. — The main distinguishing characters are the pubescent third antennal article and distinct male genitalia. The aedeagus has been illustrated by Spencer (1969).

Geographical distribution. — Known from Alaska, Alberta, British Columbia, Manitoba and Quebec. The Alberta locality is as follows:

CANADA. Alberta: Banff, Mt. Eisenhower (Spencer, 1969).

Genus *Phytomyza* Fallén

Phytomyza Fallén, 1810:21.

The main distinguishing characters of this genus are subcosta weakly developed distally and joined to costa independent of R_1 ; orbital setulae proclinate; costa extended to vein R_{4+5} and crossvein m-m normally absent.

The members of this genus as defined presently on the basis of the direction of orbital setulae and shortened costa, form a very diverse assemblage of many groups. The discovery and use of the characters of male genitalia in agromyzid taxonomy have proved beyond doubt that species extremely similar in external characteristics may have very conspicuous differences in genitalic structures. A close look at any of the recent keys shows that many species and even sometimes genera can be distinguished by examination of characters of male genitalia only. Attempts to divide this genus into various groups have not been successful as characters of male genitalia were not taken into consideration. It is not possible to undertake the full scale revision of this genus as at present the phallic structures of numerous species have not been illustrated.

This is the largest genus of agromyzid flies with about 400 described species in the world. Spencer (1969) reported 83 species for Canada, of which he recorded 41 as occurring in Alberta. Fifteen new species are described in this genus here and four additional species are recorded as new to Alberta. *P. flavicornis* Fallén which has been reported as occurring in Alberta (Spencer, 1969) is not considered here as the Alberta specimens collected from the same locality as those of Spencer's proved to be a new species *luteiceps* described here, distinguishable from *flavicornis* Fallén in the characters of the male genitalia. This genus is now represented in Alberta by 59 described species and in Canada by 98 species. Necessary amendments to include the further new species in Spencer's (1969) key to Canadian species are given.

Key to Alberta species of the genus *Phytomyza* Fallén

1(0).	Frons basically pale, yellow, orange or reddish.	2
-	Frons basically dark, brown or black	41
2(1).	Scutellum all or partially yellow	3
-	Scutellum dark, grey or black	5
3(2).	Third antennal article black or dark brown	4
-	Third antennal article yellow	<i>major</i> Malloch, p. 368
4(3).	Upper Ors shorter than lower; aedeagus with up to eight coils.	
-	. . . . .	<i>ranunculi</i> (Schrank), p. 375
-	Two Ors equal	<i>clematiphaga</i> Spencer, p. 361

5(2).	Femora mostly yellow	6
-	Femora mostly dark, at most with yellow distal tips	7
6(5).	Third antennal article black	<i>miranda</i> Spencer, p. 370
-	Third antennal article yellow; aedeagus as in Fig. 106	<i>luteiceps</i> n. sp., p. 368
7(5).	Sides of thorax including humeral and notopleural areas yellow	8
-	Sides of thorax dark, at most upper margins of mesopleura with narrow yellow band	12
8(7).	Third antennal article with normal pubescence	9
-	Third antennal article with conspicuously long pubescence	<i>riparia</i> n. sp., p. 376
9(8).	Upper Ors shorter than lower or lacking	10
-	Two Ors equal; hypopleuron and sternopleuron largely yellow	<i>petasiti</i> Spencer, p. 373
10(9).	Second costal segment two and a half to three times length of fourth	11
-	Second costal segment longer, approximately four times length of fourth	<i>spondylii</i> R.-D., p. 379
11(10).	Second antennal article black; hind margins of eyes black	<i>solidaginivora</i> Spencer, p. 378
-	Second antennal article yellow; hind margins of eyes yellow	<i>matricariae</i> Hendel, p. 369
12(7).	Upper Ors shorter than lower or lacking	13
-	Two Ors equal	19
13(12).	Frons partly darkened	<i>prava</i> Spencer, p. 374
-	Frons almost entirely yellow	14
14(13).	Second costal segment more than three and a half times length of fourth	15
-	Second costal segment less than three and a half times length of fourth	17
15(14).	Upper Ors present; aedeagus as in Fig. 81, 82	<i>aquilegioides</i> n. sp., p. 355
-	Upper Ors invariably lacking; larvae leaf miner on <i>Heracleum</i>	16
16(15).	Second costal segment three and a half times length of fourth	<i>lanati</i> Spencer, p. 367
-	Second costal segment four to four and a half times length of fourth	<i>spondylii</i> R.-D., p. 379
17(14).	Upper Ors normally lacking	18
-	Upper Ors present; aedeagus as in Fig. 93, 94	<i>columbinae</i> n. sp., p. 362
18(17).	Second costal segment more than three times length of fourth, approximately 3.3 times; notopleural areas dark; larvae make linear leaf mines on <i>Aster conspicuus</i> Lindl	<i>asterophaga</i> Spencer, p. 358
-	Second costal segment less than three times length of fourth; notopleural areas yellowish; larvae make linear leaf mines on <i>Aster ciliolatus</i> Lindl	<i>ciliolati</i> Spencer, p. 360
19(12).	Third antennal article with conspicuously long pubescence; aedeagus as in Fig. 104	<i>lactuca</i> Frost, p. 366
-	Third antennal article with normal pubescence	20
20(19).	Broad epistoma present; gena deeply extended	21
-	Mouth margin normal	24
21(20).	Second antennal article black	22
-	Second antennal article yellowish	23
22(21).	Larger specimens, wing length 3.0-3.4 mm	<i>illustris</i> Spencer, p. 365
-	Smaller specimens, wing length about 2.4 mm in male; aedeagus as in Fig. 88, 89	

- *blairmorensis* n. sp., p. 358
- 23(21). Mesonotum light grey *lupini* Sehgal, p. 367
- Mesonotum darker, blackish grey *aquilegiophaga* Spencer, p. 356
- 24(20). Acrostichals in three to six rows 25
- Acrostichals at most in two rows 31
- 25(24). Frons slightly darkened above lunule; aedeagus as in Fig. 126
..... *solidaginophaga* n. sp., p. 378
- Frons entirely pale 26
- 26(25). Gena deep, approximately one-third to one-half eye height 27
- Gena narrower, one-sixth to one-fifth vertical eye height 29
- 27(26). Orbits yellow; third antennal article distinctly elongate
..... *banffensis* Spencer, p. 358
- Orbits black; third antennal article not so elongate 28
- 28(27). Mesonotum paler grey; frons entirely yellow *urbana* Spencer, p. 381
- Mesonotum darker grey; frons slightly brownish yellow
..... *subtilis* Spencer, p. 380
- 29(26). Fore-tibia yellowish; gena approximately one-fifth eye height; aedeagus as in Fig.
133 *timida* Spencer, p. 381
- Fore-tibia dark; gena approximately one-sixth eye height; larvae blotch-miners on
leaves of *Aquilegia* and *Thalictrum* 30
- 30(29). Aedeagus as in Fig. 81, 82 *aquilegioides* n. sp., p. 355
- Aedeagus as figured by Spencer (1969) *aquilegiana* Frost, p. 354
- 31(24). Acrostichals lacking or at most three to four isolated hairs present 32
- Acrostichals in two rows 36
- 32(31). Squamal fringe dark; second costal segment about twice length of fourth 33
- Squamal fringe pale; second costal segment one and a half times length of fourth
..... 34
- 33(32). Aedeagus with distiphallus distinctly curved (Fig. 123)
..... *senecionella* n. sp., p. 377
- Aedeagus with distiphallus paler and not so curved, as figured by Spencer (1969)
..... *syngenesiae* (Hardy), p. 380
- 34(32). Second antennal article black; larva leaf miner on *Penstemon*
..... *penstemonis* Spencer, p. 373
- Second antennal article yellow or slightly brownish 35
- 35(34). Fore-coxae bright yellow; second antennal article yellow
..... *plantaginis* R.-D., p. 374
- Fore-coxae dark; second antennal article brownish; aedeagus as in Fig. 91
..... *colemanensis* n. sp., p. 361
- 36(31). Fore-coxae dark 37
- Fore-coxae yellow 39
- 37(36). Squamal fringe dark 38
- Squamal fringe pale; aedeagus as in Fig. 130, 131 *subalpina* n. sp., p. 379
- 38(37). Aedeagus with distiphallus membranous, as figured by Spencer (1969)
..... *fuscula* Zetterstedt, p. 364
- Aedeagus with distiphallus darkly sclerotized as in Fig. 84; larva leaf miner on
Arnica *arnicivora* n. sp., p. 357
- 39(36). Frons distinctly projected above eyes in profile 40
- Frons not so projected; aedeagus as in Fig. 114 *misella* Spencer, p. 371
- 40(39). Gena deep, about two-third eye height; aedeagus as illustrated (Spencer, 1969)
..... *subtenella* Frost, p. 380

- *oxytropidis* n. sp., p.372
- 58(56). Mesonotum black 59
- Mesonotum paler, greyish. 60
- 59(58). Gena deep, about one-half of eye height; broad rings below eyes formed by orbits
..... *merula* Spencer, p. 370
- Gena narrower at most one-fourth eye height; aedeagus as in Fig. 99
..... *gregaria* Frick, p. 364
- 60(58). Frons distinctly projected; orbits well differentiated
..... *evanescens* Hendel, p. 364
- Frons not projected; orbits normal 61
- 61(60). Frons slightly pale above; distiphallus with distinctly curved distal processes, as
figured by Spencer (1969) *queribunda* Spencer, p. 375
- Frons entirely black 62
- 62(61). Smaller specimens, wing length about 1.75-2.0 mm; aedeagus as figured by Spen-
cer (1969). *caprifoliae* Spencer, p. 360
- Larger specimens, wing length 2.0-2.3 mm; aedeagus with smaller hypophallus
and stouter distiphallus, as figured by Spencer (1969)
..... *periclymeni* de Meijere, p. 373

Phytomyza agromyzina Meigen

Phytomyza agromyzina Meigen, 1830:191.

Comparison and diagnostic characters. — The members of this species belong to the group having dark frons and two Ors equal. The adults are quite distinctive in having brownish yellow tibiae and tarsi. They resemble those of *P. notopleuralis* Spencer from which they may be separated by having predominantly dark pleura and distinct male genitalia. Spencer (1969) illustrated the distinctive aedeagus. Other distinguishing characters of the adults are: wing length approximately 2.0 mm; mesonotum with slight yellow on humeral and notopleural areas; antennae dark; third antennal article rounded apically, with normal pubescence; and dark femora.

Biology. — Larvae make linear mines in the leaves of *Cornus stolonifera* Michx. and *C. canadensis* L., family Cornaceae.

Geographical distribution. — Known from Europe (Hendel, 1935) and in the United States from California and Washington (Frick, 1959) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Edmonton, White Mud Creek park, 19.v.1968; 2 ♂♂ same locality, 10.vi.1968, coll. G. C. D. Griffiths; 2 ♂♂ same locality, 4.v. and 8.vi.1969. Numerous leaf mines around Edmonton on *Cornus stolonifera* Michx.

Phytomyza aquilegiana Frost

Phytomyza aquilegiana Frost, 1930:459.

Comparison and diagnostic characters. — The members of this species belong to the group having yellow frons; dark scutellum and pleura; third antennal article black, with normal pubescence; two Ors equal. The adults resemble those of a sympatric species, *P. aquilegoides* new species, in external characteristics and can be reliably separated only by examination of male genitalia. Spencer (1969) illustrated the distinctive aedeagus.

Biology. — Larvae make blotch mines in the leaves of *Aquilegia* spp. and *Thalictrum* spp., family Ranunculaceae.

Geographical distribution. — Known from United States (Frick, 1959) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♀ Edmonton, University of Alberta campus, from blotch leaf mines on *Aquilegia* sp. (cultivated), coll. 16-18.vii.1966, emerged 14.iii.1967; numerous leaf mines around Edmonton on *Aquilegia* sp.; Yukon Territory: 1 ♂ Teslin Lake, from leaf mines on *Aquilegia brevistyla* Hook., coll. 11.viii.1968, emerged, 10.v.1969, coll. G. C. D. Griffiths.

Phytomyza aquilegioides new species

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; normal mouth margin; dark scutellum; mostly dark femora and pleura; and three to six rows of acrostichals. The upper orbital bristles vary in length from almost equal to two-thirds the length of lower. Therefore, this species has been included in two couplets in Spencer's (1969) key to Canadian species of the genus *Phytomyza* Fallén as amended below:

19. Only 1 Ors present; second costal section at most three and one-third times length of fourth *asterophaga* Spencer
 - Both Ors present; second costal section three and one-half to four times length of fourth 19a
 19a. Lower Ors only slightly weaker than upper; aedeagus as in Fig. 81, 82
 *aquilegioides* n. sp.
 - Invariably small upper Ors present; aedeagus not so. 20
 36. Jowls deep, almost one-half eye height; third antennal segment distinctly elongate; aedeagus as illustrated (Spencer, 1969). *banffensis* Spencer
 - Jowls narrower, about one-sixth eye height; third antennal segment rounded 36a
 36a. Aedeagus as illustrated (Spencer, 1969) *aquilegiana* Frost
 - Aedeagus as in Fig. 81, 82 *aquilegioides* n. sp.

Description. — Head. Frons approximately 1.5 times width of eye at level of front ocellus, not projected in front of eye margin in profile. Mouth margin normal; lunule high. Two Ors, directed upwards, length of upper Ors varies from equal to two-thirds length of lower; two Ori, directed inwards and upwards, almost equal in size; orbital setulae six to seven, proclinate. Eyes oval, approximately 1.35 times higher than their length, bare; ocellar triangle small. Gena approximately one-sixth vertical eye height. Third antennal article rounded at tip, with normal pubescence; arista normal, with long pubescence.

Mesonotum. Dorsocentrals 3+1 strong bristles; acr four to five irregular rows.

Wing. Length approximately 2.1-2.5 mm; costa extended to vein R_{4+5} ; costal segments 2-4 in the ratio of 1 : 0.28 : 0.27; crossvein m-m absent.

Male genitalia (Fig. 80-82). Hypandrium (Fig. 80) V-shaped, with narrow side arms and short, broad apodeme; pregonites broad, postgonites elongate; surstyli normal; aedeagus (Fig. 81, 82) as illustrated; ejaculatory apodeme small, fan-shaped, with small bulb.

Colour. Frons varies from bright yellow to orange; orbits and gena yellow; ocellar triangle weakly shining black; both vertical bristles on dark ground; antennae black; mesonotum, scutellum and pleura mat greyish black; humeral areas with slight yellow; coxae black; femora dark, with yellow on distal tips; tibiae and tarsi yellowish brown; squamae and fringe pale; halteres yellow.

Derivation of the specific name. — The name *aquilegioides* indicates that the members of this species have similar biology to those of *P. aquilegiae* Hardy.

Biology. — Larvae make blotch mines on the leaves of *Aquilegia formosa* Fisch. and

Thalictrum venulosum Trel., family Ranunculaceae. Pupation takes place outside the mine. The dark brown puparia measure approximately 1.75 mm x 0.8 mm, and are covered all over with conspicuous tubercles and spines, as in the palaeartic species *P. thalicticola* Hendel.

Geographical distribution. — The members of this species are known only from the localities of their type specimens as below:

CANADA. Alberta: Holotype ♂ Edmonton, White Mud Creek park, from leaf mines on *Thalictrum venulosum* Trel., coll. 5.ix.1968. em. 5.xii.1968; paratypes 1 ♂ same data, emerged 29.xi.1968.

ALASKA. Paratypes 1 ♂, 2 ♀♀ Chilkat, near Haines, from leaf mines on *Aquilegia formosa* Fisch., coll. 29.vi.1968, emerged 22.vii.1968, 12.x.1968 and 21.v.1968, coll. G. C. D. Griffiths.

Phytomyza aquilegiophaga Spencer

Phytomyza aquilegiophaga Spencer, 1969:227.

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; dark scutellum; mostly dark pleura and femora; third antennal article black, with normal pubescence and broad epistoma. The adults resemble those of *P. lupini* Sehgal but differ in having darker or blackish grey mesonotum and distinct male genitalia. They differ from other related species, *P. affinalis* Frost, *P. blairmorensis* new species and *P. illustris* Spencer, in having second antennal article yellowish brown. Spencer (1969) illustrated the distinctive aedeagus.

Biology. — Larvae bore inside the stems of *Aquilegia* sp. (cultivated), family Ranunculaceae, and pupate at the stem base. The dark brown pupae can be found during late summer.

Geographical distribution. — The members of this species are known from Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Edmonton, Aberhart Hospital, University of Alberta, from stem-base of *Aquilegia* sp. (cultivated), coll. 4.ix.1968, emerged 3.x.1968; 1 ♂, 3 ♀♀ same locality, swept over *Aquilegia* sp., 1.vi.1967; 2 ♂♂, 1 ♀ same locality, from stem-base of *Aquilegia* sp., coll. 3.ix.1968, emerged 26.ix.-26.x.1968, coll. G. C. D. Griffiths.

Phytomyza aquilegivora Spencer

Phytomyza aquilegivora Spencer, 1969:229.

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by dark frons, mesonotum and scutellum; upper Ors lacking; essentially dark femora and pleura and second costal segment less than three times length of fourth. The adults resemble those of *P. thalictivora* Spencer but differ in having yellowish frons and lacking acrostichals. They also differ from the similar species, *P. minuscula* Goureau, in having very different male genitalia. Spencer (1969) illustrated the aedeagus characteristic of the species.

Biology. — Larvae make linear mines on the leaves of *Aquilegia* sp. (cultivated), family Ranunculaceae. Pupation takes place outside the mine.

Geographical distribution. — The members of this species are known only from the locality of its type series from Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 5 ♂♂ Edmonton, Aberhart Hospital, University of Alberta campus, swept over *Aquilegia* sp. (cultivated), 25.vi.1969; 1 ♂ same locality, 1.vi.1967; 3 ♂♂ same

locality, from leaf mines on *Aquilegia* sp., coll. 4.ix.1968, emerged 16-19.ix.1968, 30.x.1968; 2 ♂♂ Edmonton, Garneau, from same host, coll. 3.ix.1968, emerged 15-17.ix.1968.

Phytomyza aralivora Spencer

Phytomyza aralivora Spencer, 1969:230.

Comparison and diagnostic characters. — The members of this species belong to the group characterized by dark frons, mesonotum and scutellum; upper Ors shorter than lower; and second costal segment more than three times fourth. The adults resemble those of *P. osmorhizae* Spencer but differ in having yellow tarsi and distinct male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae make linear mines on the leaves of *Aralia nudicaulis* L., family Araliaceae. Pupation takes place outside the mine.

Geographical distribution. — The members of this species are known only from Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Edmonton, river bed near University of Alberta campus, 14.vi.1969; Numerous leaf mines around Edmonton and in Elk Island park on *Aralia nudicaulis* L.

Phytomyza arnicivora new species

Comparison and diagnostic characters. — The main distinguishing characters of the members of this species are pale frons; two equal Ors; third antennal article normal; mouth margin normal; mesonotum, pleura and scutellum all mat greyish black; femora black, with slight yellow on distal tips and squamal fringe dark. The adults resemble those of *P. fuscula* Zetterstedt and can be reliably distinguished only by examination of male genitalia. The members of this species are included in Spencer's (1969) key to Canadian species of the genus *Phytomyza* Fallén by extending the couplet 50 as below:

- | | | |
|------|---|--------------------------|
| 50. | Mesopleura entirely grey | 50a |
| - | Mesopleura with upper margins narrowly yellow | 51 |
| 50a. | Aedeagus with distiphallus membranous, as illustrated (Spencer, 1969) | |
| | <i>fuscula</i> Zetterstedt | |
| - | Aedeagus with distiphallus sclerotized, as in Fig. 84. | <i>arnicivora</i> n. sp. |

Description. — Head. Frons approximately twice width of eye at level of front ocellus, not projected in front of eye margin in profile. Mouth margin normal. Two Ors, equal in size, directed upwards; one large Ori and a small hair below, directed inwards and upwards; orbital setulae few, approximately eight to nine, proclinate. Eyes oval, almost equal in height to their length; ocellar triangle small. Gena approximately one-fourth vertical eye height. Third antennal article rounded at tip, with normal pubescence, arista normal, pubescent.

Mesonotum. Dorsocentrals 3+1 strong bristles; acr in two rows.

Wing. Length in male 2.4 mm; costa extended to vein R_{4+5} ; costal segments 2-4 in the ratio of 1 : 0.3 : 0.5; crossvein m-m absent.

Male genitalia (Fig. 83-85). Hypandrium (Fig. 83) small, side arms broad, no apodeme; pregonites broad; postgonites elongate; surstyli normal; aedeagus complex as illustrated in Fig. 84; ejaculatory apodeme (Fig. 85) small, bulb small and membranous.

Colour. Frons pale whitish, slightly darkened at centre; orbits pale; gena yellowish; ocellar triangle weakly shining black; vte on black and vti on margin of dark and yellow grounds; antennae black; mesonotum, scutellum and pleura mat greyish black; coxae black; femora black, with slight yellow on distal tips; tibiae and tarsi black; squamae pale, fringe dark;

halteres pale.

Derivation of the specific name. — This species is named after the generic name of its food plant.

Biology. — Larvae make linear leaf mines on *Arnica cordifolia* Hook., family Compositae. Pupation occurs inside the leaf mine and the whitish puparia can be collected during July and August.

Geographical distribution. — The members of this species are known only from the type locality:

CANADA. Alberta: Holotype ♂ Jasper National Park, near Medicine Lake; from leaf mines on *Arnica cordifolia* Hook., coll. 16.vii.1969, emerged 24.vii.1969, coll. G. C.D. Griffiths; Numerous leaf mines on the same host around Jasper.

Phytomyza asterophaga Spencer

Phytomyza asterophaga Spencer, 1969:230.

Comparison and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; dark scutellum; essentially dark femora and pleura and upper Ors lacking. The adults resemble those of *P. ciliolati* Spencer and differ in having a darker notopleural area and different biology. Spencer (1969) illustrated the aedeagus and leaf mine distinctive of this species.

Biology. — Larvae make linear mines on the leaves of *Aster conspicuus* Lindl., family Compositae. The leaf mines are distinctive in having frass disposed in the form of discrete granules alternately in the mine. Pupation occurs outside the mine.

Geographical distribution. — The members of this species were previously known only from the locality of type series from Western Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Blairmore, 26.vi.1966; 1 ♂ Edmonton, White Mud Creek park, from leaf mines on *Aster conspicuus* Lindl., coll. 10.ix.1966, emerged 8.iii.1967; 2 ♂♂ Elk Island park, same host, emerged 4.vi.1967.

Phytomyza banffensis Spencer

Phytomyza banffensis Spencer, 1969:231.

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; essentially dark scutellum, pleura and femora; acrostichals in three to six rows and third antennal article with normal pubescence. The adults resemble those of *P. aquilegiana* Frost and *P. aquilegioides* new species but differ in having deeper gena, approximately one-half of vertical eye height, elongate third antennal article and distinct male genitalia. Spencer (1969) illustrated the distinctive aedeagus.

Geographical distribution. — The members of this species were previously known only from the locality of its type series from western Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 2 ♂♂ Jasper, 17.vi.1966.

Phytomyza blairmorensis new species

Comparison and diagnostic characters. — A member of this species belongs to the group characterized by yellow frons; two equal Ors; broad epistoma; normal third antennal segment; dark scutellum and mostly dark femora and pleura. The adult resembles those of

P. lupini Sehgal and *P. aquilegiophaga* Spencer but differs in having second antennal article black and distinct male genitalia. It also resembles other similar species, *P. illustris* Spencer and *P. affinalis* Frost, and may be separated from them as shown below in extension to Spencer's (1969) key to Canadian species of the genus *Phytomyza* Fallén.

- 29a. Large specimens, wing length 3.0-3.4 mm; normally one Ors . . . *illustris* Spencer
 - Smaller specimens, wing length at most 2.4 mm in male; two Ors 29b
 29b. Frons entirely yellow; aedeagus as illustrated (Spencer, 1969). . . . *affinalis* Frost
 - Frons slightly darkened; aedeagus as in Fig. 88, 89 *blairmorensis* n. sp.

Description. — Head. Frons approximately 2.5 times width of eye at level of front ocellus; orbits broad, distinctly projected in front of eye margin in profile; broad epistoma. Two equal Ors, directed upwards; two Ori, directed inwards and upwards, lower one weaker than upper; orbital setulae few, six to seven, proclinate. Eyes oval, slightly slanted, their vertical height being approximately 1.25 times their length; ocellar triangle small. Gena approximately one-third vertical eye height. Third antennal article large, circular, with normal pubescence; arista normal, pubescent.

Mesonotum. Dorsocentrals 3+1 strong bristles; acr approximately eight to nine, in two rows.

Wing. Length in male approximately 1.75 mm; costa extended to vein R_{4+5} ; costal segments 2-4 in ratio of 1 : 0.35 : 0.65; crossvein m-m absent.

Male genitalia (Fig. 86-90). Hypandrium (Fig. 86) V-shaped, narrow side arms, no distinct apodeme; pregonites broad; postgonites (Fig. 87) long, with hook-like process anteriorly; aedeagus (Fig. 88, 89) as illustrated; ejaculatory apodeme (Fig. 90) small, well sclerotized, bulb small, membranous.

Colour. Frons yellow, very slightly darkened above; orbits yellow, darkened slightly near upper Ors; gena and lunule yellow; ocellar triangle weakly shining black; both Vt 's on dark ground; antennae black; mesonotum, scutellum and pleura mat grey; legs black, only distal tips of femora with slight yellow; squamae pale, fringe brown; halteres yellow.

Derivation of the specific name. — This species is named after the locality of its type specimen.

Geographical distribution. — A member of this species is known only from the type locality:

CANADA. Alberta: Holotype ♂ Blairmore, 26.vi.1966.

Phytomyza canadensis Spencer

Phytomyza canadensis Spencer, 1969:231.

Comparison and diagnostic characters. — The main distinguishing characters of the members of this species are: dark frons; two equal Ors; brilliantly shining black mesonotum and scutellum; acrostichals in approximately two rows; dark tarsi and second costal segment less than three times length of fourth. The adults resemble those of the very similar species, *P. multifidae* new species, but differ in having narrower orbits and different puparia.

Biology. — The larvae were stated by Spencer (1969) to make linear mines in the leaves of *Anemone canadensis* L., family Ranunculaceae. The characteristic leaf mines have been illustrated by Spencer (1969). However, a confusion seems to have arisen, since the leaf figured by Spencer is clearly not of this species. Mr. Griffiths and I have found similar leaf mines only on *Anemone riparia* Fern., never on *A. canadensis* L. The mined leaf figured by Spencer was probably also of *A. riparia* Fern.

Geographical distribution. — The members of this species are known only from Canada

from the type locality (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: Numerous empty leaf mines on *Anemone riparia* Fern., Edmonton, White Mud Creek park, 5-6.ix.1968, and in Elk Island park.

Phytomyza caprifoliae Spencer

Phytomyza caprifoliae Spencer, 1969:233.

Comparison and diagnostic characters. — The main distinguishing characters of the members of this species are: frons black, not projected; two equal Ors; normal third antennal article; mat grey mesonotum, scutellum and pleura; approximately four rows of acr; black tarsi and second costal segment less than three times length of fourth. The adults resemble those of *P. periclymeni* de Meijere and can be reliably separated only by examination of male genitalia. Spencer (1969) illustrated the distinctive aedeagus.

Biology. — Larvae mine the leaves of *Symphoricarpos* sp., family Caprifoliceae.

Geographical distribution. — The members of this species are known only from the locality of its type series from Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 2 ♂♂, 6 ♀♀ Edmonton, White Mud Creek park, from leaf mines on *Symphoricarpos* sp., coll. 10.ix.1966, emerged 9.i.-7.iii.1967; 2 ♂♂ same locality, 14.v.1968 and 8.vi.1967.

Phytomyza ciliolati Spencer

Phytomyza ciliolati Spencer, 1969:234.

Comparison and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; dark scutellum; essentially dark femora and pleura and upper Ors absent. The adults resemble those of *P. asterophaga* Spencer but differ in having yellow on notopleural areas and different biology.

Biology. — Larvae make linear mines on the leaves of *Aster ciliolatus* Lindl., family Compositae. The leaf mines are distinctive in having frass disposed in continuous streaks. Pupation occurs outside the mine. Spencer (1969) illustrated the characteristic leaf mine.

Geographical distribution. — The members of this species are known only from the type locality (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: Numerous leaf mines on *Aster ciliolatus* Lindl. around Edmonton during July and August.

Phytomyza cineracea Hendel

Phytomyza cineracea Hendel, 1920:160.

Comparison and diagnostic characters. — The main diagnostic characters of the members of this species are: yellowish brown frons; mat grey mesonotum and scutellum; black tarsi and second costal segment approximately two times the length of the fourth. The adults are distinctive in having an elongate third antennal article. They differ from those of the similar species, *P. erigerontophaga* Spencer, in having frons distinctly projected above eyes and distinct male genitalia. Griffiths (1968) and Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae of this species feed inside the stems of *Ranunculus* spp., Ranunculaceae (Griffiths, 1968).

Geographical distribution. — The members of this species are known from Europe, Ice-

land (Griffiths, 1968) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 8 ♂♂ Blairmore, swept over *Ranunculus acris* L., family Ranunculaceae, 26.vi.1966, 3 ♂♂ Jasper, 16-19.vi.1966.

Phytomyza clematiphaga Spencer

Phytomyza clematiphaga Spencer, 1969:236.

Comparison and diagnostic characters. — The members of this species belong to the group characterized by yellow frons and partially yellow scutellum. The adults differ from those of *P. major* Malloch in having their body darker and third antennal article black. They differ from those of *P. ranunculi* (Schrank) in having both Ors of equal length and distinct male genitalia. Spencer (1969) illustrated the distinctive aedeagus.

Biology. — Larvae make linear mines on the leaves of *Clematis verticillaris* DC. family Ranunculaceae. Pupation occurs inside the leaf mine.

Geographical distribution. — The members of this species are known from Canada only from the type locality. I examined the following material from Alberta:

CANADA. Alberta: Holotype ♂ (in K. A. Spencer's collection) Edmonton, river bed near University of Alberta campus, from leaf mines on *Clematis verticillaris* DC, coll. 26.vii.1966, emerged 7.viii.1966, coll. B. Hocking; paratype 1 ♀ (in K. A. Spencer's collection) Edmonton, University of Alberta campus, from same host, coll. 24.ix.1966, emerged 9.x.1966; 2 ♂♂, 4 ♀♀ Edmonton, river bed near University of Alberta campus, same host, coll. 26.vii.1966, emerged 6-12.viii.1966, coll. B. Hocking; 4 ♀♀ Edmonton, University of Alberta campus, same host, coll. 23.ix.1966, emerged 1.x.1966, 4.ii.1967 and 11.iii.1967.

Phytomyza colemanensis new species

Comparison and diagnostic characters. — A member of this species belongs to the group characterized by yellow frons; two equal Ors; mouth margin normal; third antennal article with normal pubescence; dark scutellum; mostly dark femora and pleura; and acrostichals approximately three to four scattered hairs. The adult resembles those of *P. penstemonis* Spencer and *P. plantaginis* R.-D. from which it may be separated as shown below in the extension to Spencer's (1969) key to Canadian species of the genus *Phytomyza* Fallén:

- | | | |
|------|--|----------------------------|
| 41. | Fore-coxae essentially dark | 41a. |
| - | Fore-coxae conspicuously yellow. | <i>plantaginis</i> R.-D. |
| 41a. | First and second antennal segment black; aedeagus as illustrated (Spencer, 1969) | <i>penstemonis</i> Spencer |
| - | First and second antennal segment yellowish brown; aedeagus as in Fig. 91. | <i>colemanensis</i> n. sp. |

Description. — Head. Frons almost twice width of eye at level of front ocellus, slightly projected in front of eye margin in profile. Mouth margin normal. Two equal Ors directed upwards; one strong Ori incurved, one small hair present below Ori; orbital setulae only two, proclinate. Eyes slightly slanted, their vertical height 1.2 times their length, bare; ocellar triangle small. Gena approximately one-third vertical eye height. Third antennal article with slight angle anterodorsally, with normal pubescence; arista normal, pubescent.

Mesonotum. Dorsocentral 3+1 strong bristles; acr few, three to four scattered hairs.

Wing. Length in male 1.6 mm; costa extended to vein R_{4+5} ; costal segments 2-4 in the ratio of 1 : 0.3 : 0.7; crossvein m-m absent.

Male genitalia (Fig. 91). Hypandrium U-shaped, with broad side arms; pregonites broad;

postgonites elongate, with curved process anteriorly; surstyli normal; aedeagus (Fig. 91) with distinctive hypophallus; ejaculatory apodeme broad, bulb small and membranous.

Colour. Frons, orbits and gena yellow; ocellar triangle weakly shining black; Vte on black and Vti on margin of dark and yellow ground; first and second antennal articles yellowish brown; third antennal article black; legs black; mesonotum, scutellum and pleura mat greyish; squamae and fringe pale.

Derivation of the specific name. — This species is named *colemanensis* after the name of the type locality.

Geographical distribution. — A member of this species is known only from the type locality:

CANADA. Alberta: Holotype ♂ Coleman, 27.vi.1966.

Phytomyza columbinae new species

Comparison and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; upper Ors shorter than lower; dark scutellum; essentially dark femora and pleura. The adults differ from those of the similar species, *P. timida* Spencer, and may be separated as shown below in extension to Spencer's (1969) key to Canadian species of the genus *Phytomyza* Fallén:

24. Jowls narrow, one-fifth to one-fourth vertical eye height. 24a
 - Jowls deeper, one-third to one-half vertical eye height. 25
 24a. Fore-tibia yellowish; aedeagus as illustrated (Spencer, 1969) *timida* Spencer
 - Fore-tibia dark; aedeagus as in Fig. 93, 94 *columbinae* n. sp.

Description. — Head. Frons approximately twice width of eye at level of front ocellus, not projected in front of eye margin in profile. Mouth margin normal; lunule high. Two Ors, directed upwards, upper one shorter than lower; two Ori, directed inwards and upwards; orbital setulae few five to six, proclinate. Eyes oval, approximately 1.2 times higher than their length, bare; ocellar triangle small. Gena approximately 0.22 times vertical eye height. Third antennal article rounded at tip, with normal pubescence; arista normal, pubescent.

Mesonotum. Dorsocentrals 3+1 strong bristles; acr in four to five irregular rows.

Wing. Length 1.5-1.8 mm; costa extended to vein R_{4+5} ; costal segments 2-4 in the ratio of 1 : 0.33 : 0.4; crossvein m-m absent; wing tip at M_{3+4} .

Male genitalia (Fig. 92-95). Hypandrium (Fig. 92) V-shaped, with small apodeme; pregonites broad; postgonites elongate; surstyli normal; aedeagus (Fig. 93, 94) as illustrated; ejaculatory apodeme (Fig. 95) small, fan-shaped, bulb small, membranous.

Colour. Frons and gena pale; orbits slightly darkened, lunule dark; ocellar triangle shining black; antennae black; both Vt's on dark ground; mesonotum, scutellum and pleura mat greyish black; legs black; squamae pale, fringe brown; halteres yellow.

Derivation of the specific name. — This species is named *columbinae* after the common name of its food plant, columbine (*Aquilegia*).

Biology. — Larvae make blotch mines in the leaves of *Aquilegia* sp. (cultivated) and *Thalictrum venulosum* Trel., family Ranunculaceae. Pupation occurs outside the mine. The dark brown puparium measures approximately 1.5 mm x 0.75 mm and is densely covered with small spinules.

Geographical distribution. — The members of this species are known only from the type locality:

CANADA: Alberta: Holotype ♂ Edmonton, White Mud Creek park, from blotch mines on *Thalictrum venulosum* Trel., coll. 6.ix.1968, emerged 19.x.1968; paratypes 2 ♂♂ Edmonton, Aberhart Hospital, University of Alberta campus, from leaf mines on *Aquilegia* sp.

(cultivated), coll. 4.ix.1968, emerged 18.ix.1968 and 2.ii.1969; 2 ♂♂ same locality, swept over *Aquilegia* sp., 25.vi.1969; 1 ♂ Edmonton, University of Alberta campus, from leaf mines on *Aquilegia* sp., coll. 13.vi.1969, emerged 17.vi.1969; 2 ♂♂ Edmonton, Rainbow Valley, from leaf mines on *Thalictrum venulosum* Trel., coll. 14.vi.1968.

Phytomyza delphinivora Spencer

Phytomyza delphinivora Spencer, 1969:238.

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by dark frons, mesonotum and scutellum; essentially dark femora and pleura; upper Ors shorter than lower and second costal segment less than three times length of fourth. The adults differ from those of the similar species, *P. mertensiae* new species and *P. prava* Spencer, in having only two rows of acrostichals and distinct male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae mine the leaves of *Delphinium* sp. (cultivated), family Ranunculaceae. Spencer (1969) illustrated the characteristic linear mine. Pupation occurs outside the mine.

Geographical distribution. — The members of this species are known only from the type locality (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 2 ♂♂ Edmonton, White Mud Creek park, 28.v.1967; Numerous leaf mines around Edmonton on *Delphinium* sp. (cultivated).

Phytomyza edmontonensis new species

Comparisons and diagnostic characters. — A member of this species belongs to the group characterized by dark frons; upper Ors absent; essentially dark femora and pleura; mat greyish black mesonotum and scutellum; and second costal segment more than three times length of fourth. The adult resembles that of *P. modica* Spencer from which it may be separated as shown below in an extension to Spencer's (1969) key to Canadian species of the genus *Phytomyza* Fallén:

78. Second costal section long, five times length of fourth. *pallipes* Spencer
 - Second costal section shorter, up to 3.5 times length of fourth 78a
 78a. Second costal section slightly over three times length of fourth; veins pale; aedeagus as illustrated (Spencer, 1969). *modica* Spencer
 - Second costal section 3.5 times length of fourth; veins brownish; aedeagus as in Fig. 97 *edmontonensis* n. sp.

Description. — Head. Frons approximately twice width of eye at level of front ocellus, not projected in front of eye margin in profile. One Ors, curved upwards; three strong Ori directed inwards; orbital setulae numerous, proclinate. Eyes almost circular, their vertical height being 1.1 times their length; ocellar triangle small. Gena narrow, approximately 0.3 times eye height midway between vibrissal and posterior margins. Third antennal article slightly enlarged, rounded at tip, with normal pubescence; arista normal, pubescent.

Mesonotum. Dorsocentrals 3+1 strong bristles; acr in three irregular rows.

Wing. Length in male 2.4 mm; costa extended to vein R_{4+5} ; costal segments 2-4 in the ratio of 1 : 0.26 : 0.3; crossvein m-m absent.

Male genitalia (Fig. 96-98). Hypandrium (Fig. 96) U-shaped, with broad side arms, pregonites elongate; postgonites broad anteriorly and with a small hook; surstyli small; aedeagus (Fig. 97) darkly sclerotized and as illustrated; ejaculatory apodeme (Fig. 99) very broad, bulb small and membranous, latter with darkly sclerotized areas.

Colour. Frons, orbits and gena brown; ocellar triangle black; mesonotum, scutellum and

pleura mat black; femora black, tibiae and tarsi yellowish brown; wing veins brownish; squamae and fringe pale; halteres yellow.

Derivation of the specific name. — This species is named after the type locality.

Geographical distribution. — A member of this species is known only from the type locality:

CANADA. Alberta: Holotype ♂ Edmonton, White Mud Creek park, 18.vi.1968, coll. G. C. D. Griffiths.

Phytomyza evanescens Hendel

Phytomyza evanescens Hendel, 1920:167.

Comparisons and diagnostic characters. — The diagnostic characters of the members of this species are: dark frons; two equal Ors; normal third antennal article; mat grey mesonotum, scutellum and pleura; dark tarsi; second costal segment less than three times length of fourth and acrostichals in approximately four rows. The adults differ from those of the similar species, *P. caprifoliae* Spencer, *P. periclymeni* de Meijere and *P. queribunda* Spencer in having frons distinctly projected and characteristic male genitalia. The surstyli have long wing-like processes. Griffiths (1964) illustrated the male genitalia characteristic of this species. Spencer (1969) also figured the aedeagus.

Biology. — Larvae feed inside the stems of *Ranunculus* spp., family Ranunculaceae (Griffiths, 1969).

Geographical distribution. — The members of this species are known from Europe, Iceland, Faroes (Griffiths, 1968) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Blairmore, 26.vi.1966; 2 ♂♂ Jasper, 16-19.vi.1966.

Phytomyza fuscula Zetterstedt

Phytomyza fuscula Zetterstedt, 1848:2831; Spencer, 1969:242.

Comparison and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; dark scutellum; essentially dark femora and pleura; mouth margin normal; third antennal article black, with normal pubescence; two Ors equal; acr in two well-defined rows and dark fore-coxae.

Spencer (1969) groups this species both under yellow frons and dark frons. The Alberta specimens correspond to the colour form having yellow frons. The aedeagus of Alberta specimens corresponds exactly to that figured by Spencer (1969) including the weakly sclerotized membranous processes in the distiphallus. Griffiths' (1969) description of *fuscula* Zett. from Greenland refers to *puccinelliae* Spencer (see Spencer, 1969).

Biology. — Larvae of this species mine the leaves of grasses (Gramineae) in Canada (Spencer, 1969).

Geographical distribution. — The members of this species are known from Europe (Hendel, 1935) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Edmonton, University of Alberta campus, 6.vi.1968; 1 ♂ Elk Island park, 31.vii.1966.

Phytomyza gregaria Frick

Phytomyza gregaria Frick, 1954:371.

Comparison and diagnostic characters. — The distinguishing characters of the members of

this species are: dark frons; two equal Ors; normal third antennal article; mat black mesonotum, scutellum and pleura; acrostichals in approximately four rows; dark tarsi and second costal segment less than three times length of fourth. The adults resemble those of the similar species, *P. periclymeni* de Meijere, but differ in having darker mesonotum; narrower gena, approximately one-fourth eye height and distinct male genitalia. The aedeagus of an Alberta specimen is illustrated in Fig. 99. Spencer (1969) also illustrated the aedeagus.

Biology. — The larvae mine the leaves of *Lonicera involucrata* (Richards) Banks, family Caprifoliaceae.

Geographical distribution. — The members of this species are known from United States (Frick, 1959) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ St. Albert, near Edmonton, 18.vi.1967; Numerous leaf mines on *Lonicera involucrata* (Richards) Banks around Edmonton

Phytomyza illustris Spencer

Phytomyza illustris Spencer, 1969:247.

Comparison and diagnostic characters. — The members of this species differ from those of similar species, *blairmorensis* new species and *affinalis* Frost, in larger size, wing length 3.0-3.4 mm and normally only one Ors. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — Known from Alberta, British Columbia and Yukon Territory. The Alberta locality is:

CANADA. Alberta: Blairmore (Spencer, 1969).

Phytomyza involucratae Spencer

Phytomyza involucratae Spencer, 1969:249.

Comparison and diagnostic characters. — The members of this species differ from those of a similar species, *mili* Kaltenbach, in having larger size, wing length 2.8-3.3 mm, grey mesonotum and third antennal article large and elongate. Spencer (1969) illustrated the distinctive aedeagus.

Geographical distribution. — Known from Alberta and British Columbia. The Alberta locality is:

CANADA. Alberta: Frank; St. Albert.

The following type specimen was examined:

CANADA. British Columbia: Paratype 1 ♂ Prince George, 17.vi.1966, coll. K. A. Spencer

Phytomyza jasperensis new species

Comparisons and diagnostic characters. — A member of this species belongs to the group characterized by yellow frons; normal mouth margin and third antennal article; two equal Ors; dark scutellum; mostly dark femora and pleura and acrostichals in two rows. The adult resembles that of *P. pedicularicaulis* Spencer and can be reliably separated only by examination of male genitalia. This species may be included in Spencer's (1969) key to Canadian species of the genus *Phytomyza* Fallén by amending couplet 43 and extending 44 as below:

43. Frons strongly projected above eyes; jowls conspicuously deep, two-thirds eye height *subtenella* Frost
 - Frons less projected; jowls at most one-half eye height. 44
 44. Arista conspicuously thickened basally. 44a

- Arista more slender, normal 45
 44a. Aedeagus as illustrated (Spencer, 1969) *pedicularicaulis* Spencer
 - Aedeagus as in Fig. 102 *jasperensis* n. sp.

Description. — Head. Frons approximately 2.5 times width of eye at level of front ocellus, projected in front of eye margin in profile. Mouth margin normal. Two equal Ors directed upwards; two Ori, lower one smaller than upper, incurved; orbital setulae few, approximately eight, proclinate. Eyes oval, their vertical height being 1.3 times their length, bare; ocellar triangle small. Gena approximately one-third eye height. Third antennal article rounded at tip, with normal pubescence; arista slightly thickened at base, pubescent.

Mesonotum. Dorsocentrals 3+1 strong bristles; acr in two rows.

Wing. Length in male 2.6 mm; costa extended to vein R_{4+5} ; costal segments 2-4 in ratio of 1 : 0.27 : 0.45; crossvein m-m absent.

Male genitalia (Fig. 100-103). Hypandrium (Fig. 100) V-shaped, with narrow side arms; pregonites broad; postgonites (Fig. 101) long, with hook-like process anteriorly, surstyli normal; aedeagal apodeme exceptionally long; aedeagus (Fig. 102) relatively short and as illustrated; ejaculatory apodeme (Fig. 103) broad, bulb small and membranous.

Colour. Frons, orbits and gena bright yellow; maxillary palpi black; ocellar triangle weakly shining black; lunule yellow; both Vt's on dark ground; first antennal article yellowish, second and third articles black; mesonotum, scutellum and plerua mat grey; only mesopleura with narrow yellow band along upper margin; legs with fore-coxae yellowish, femora dark with yellow on distal tips, tibiae and tarsi black; squamae yellow, fringe brownish; halteres yellow.

Derivation of the specific name. — The species is named *jasperensis* after the name of the type locality.

Geographical distribution. — This species is known only from the following locality: CANADA. Alberta: Holotype ♂ Jasper, 17.vi.1966.

Phytomyza lactuca Frost

Phytomyza lactuca Frost, 1924:85.

Comparison and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; dark scutellum; essentially dark pleura and femora; and two Ors equal. The adults differ from all other species in this group by having conspicuously long pubescence on the third antennal article and distinct male genitalia. The aedeagus of an Alberta specimen bred from *Crepis tectorum* L. is illustrated in Fig. 104. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae make long linear mines, usually on under surface of the leaves of *Taraxacum officinale* Weber, *Crepis tectorum* L. and *Sonchus uliginosus* Bieb., family Compositae. Larvae are also known to mine the leaves of *Lactuca scariola* var. *integrifolia* (Bogenh.) G. Beck in Pennsylvania, U. S. A. (Frost, 1924).

Geographical distribution. — The members of this species are known from United States (Frick, 1959) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Blairmore, 28.vi.1966; 1 ♂ Edmonton, river bed near University of Alberta campus, from leaf mines on *Crepis tectorum* L., coll. 15.vi.1969 emerged 12.vi.1969; 1 ♀ same locality, from leaf mines on *Sonchus uliginosus* Bieb., coll. 15.vi.1969, emerged 6.vii.1969; 3 ♀♀ Edmonton, University of Alberta campus, from leaf mines on *Taraxacum officinale* Weber, coll. 7.x.1966, emerged 19.xii.1966 and 5-6.iii.1967; 2 ♂♂, 2 ♀♀ Waterton National park, same host, coll. 6.ix.1966, emerged 10-22.ix.1966 and 25.ii.1967.

Phytomyza lanati Spencer

Phytomyza lanati Spencer, 1969:250.

Comparison and diagnostic characters. — The members of this species differ from those of a similar species, *spondylii* R.-D., in having second costal segment shorter, about 3.5 times length of fourth. These specimens cannot be satisfactorily separated on the basis of external characteristics alone; however, the male genitalia are distinct. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae mine leaves of *Heracleum*, family Umbelliferae. Details of leaf mine not known (Spencer, 1969).

Geographical distribution. — The members of this species are known from California in United States and Alberta in Canada. The Alberta locality is:

CANADA. Alberta: Jasper (Spencer, 1969).

Phytomyza lupini Sehgal

Phytomyza lupini Sehgal, 1968:73.

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; dark scutellum; mostly dark pleura and femora; two Ors equal; third antennal article black, with normal pubescence and broad epistoma. The adults resemble those of *P. aquilegiophaga* Spencer and differ in having slightly paler grey mesonotum and distinct male genitalia. They differ from another similar species, *P. blairmorensis* new species, in having the second antennal article yellowish brown and distinct male genitalia. Sehgal (1968) illustrated the head, wing and male genitalia characteristic of this species. Spencer (1969) also illustrated the aedeagus.

Biology. — Larvae bore inside the stems of *Lupinus sericeus* Pursh, family Leguminosae. The pale whitish puparia are found inside the stems. The puparia are characteristic in having a small horn in the posterior spiracles.

Geographical distribution. — The members of this species are known only from western Canada: Alberta and British Columbia (Sehgal, 1968). The material examined remain the same as reported earlier (Sehgal, 1968).

Phytomyza lupinivora Sehgal

Phytomyza lupinivora Sehgal, 1968:74.

Comparison and diagnostic characters. — The main distinguishing characters of the member of this species are: dark frons; distinctly mat greyish mesonotum and scutellum; dark tarsi; normal third antennal article and acrostichals in two rows. The adult resembles that of *P. oxytropidis* new species from which it is separated by having slightly longer second costal segment, approximately one and a quarter times the length of the fourth, and darker orbits. Sehgal (1968) illustrated the head and wing characteristic of this species.

Biology. — Larvae make linear mines on the leaves of *Lupinus sericeus* Pursh, family Leguminosae. Pupation occurs outside the mine.

Geographical distribution. — A member of this species is known only from the type locality:

CANADA. Alberta: Blairmore (Sehgal, 1968).

Phytomyza luteiceps new species

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; dark scutellum and yellow femora. The adults resemble those of *P. flavicornis* Fallén and can be separated reliably only by examination of characters of the male genitalia. Spencer (1965d, 1969) illustrated the aedeagus of *P. flavicornis* Fallén. It is doubtful at present if the true *P. flavicornis* Fallén occurs in Alberta. This species is included in Spencer's (1969) key to Canadian species of the genus *Phytomyza* Fallén, by amending and extending the couplet 10 as below:

10. All coxae yellow; jowls exceptionally deep at rear, at least two-thirds of eye height 10a
 - Mid- and hind-coxae black *rufipes* Meigen
 10a. Mesonotum black, weakly shining; aedeagus as illustrated (Spencer, 1969)
 *flavicornis* Fallén
 - Mesonotum mat greyish black; aedeagus as in Fig. 106. *luteiceps* n. sp.

Description. — Head. Frons wide, little more than three times width of eye at level of front ocellus, conspicuously projected in front of eye margin in profile. Broad epistoma present; lunule low. One strong Ors and three strong Ori; orbital setulae 10-11, proclinate. Eyes oval and slanting; their vertical height being almost equal to their length, bare; ocellar triangle small. Gena deep, approximately 0.7 times vertical eye height. Third antennal article rounded at tip, with short upcurved pubescence; arista normal and pubescent.

Mesonotum. Dorsocentrals 3+1 strong bristles; acr in approximately two rows.

Wing. Length 2.5 to 2.8 mm; costa extended to vein R_{4+5} ; costal segments 2-4 in the ratio of 1 : 0.3 : 0.4; crossvein m-m absent.

Male genitalia (Fig. 105-107). Hypandrium (Fig. 105) almost circular below, with broad arms as illustrated; pregonites broad; postgonites long with small process anteriorly; aedeagus (Fig. 106) as illustrated; ejaculatory apodeme (Fig. 107) short, bulb small.

Colour. Frons bright yellow; orbits and gena yellow; Vte on black and Vti on yellow ground; ocellar triangle shining black; lunule yellow; antennae completely yellow; arista brown; mesonotum and scutellum mat grey; humeral and notopleural areas yellow; sternopleura slightly brownish at base; meso- and pteropleura yellow; legs with coxae, femora and tibiae yellow, tarsi slightly brownish; squamae yellow, fringe brown; halteres yellow.

Derivation of the specific name. — This species is named *luteiceps* because of the mostly yellow head.

Biology. — Not confirmed, but the larvae will probably prove to feed in stems of *Urtica*.

Geographical distribution. — The members of this species are known only from the localities of its type series as below:

CANADA. Alberta: Holotype ♂ St. Albert, near Edmonton, 14.vi.1966; allotype ♀ same data; paratypes 3 ♂♂, 3 ♀♀ same data; 2 ♂♂ Jasper, 16.vi.1966.

Phytomyza major Malloch

Phytomyza major Malloch, 1913b:150.

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by yellow frons and yellow scutellum. The adults differ from those of other species in this group, *P. clematiphaga* Spencer and *P. ranunculi* (Schrank), in having a mostly yellow body, yellow third antennal article and distinct male genitalia. The adults are largely yellow flies, wing length approximately 4.0 mm. Spencer (1969) illustrated the distinctive aedeagus. The aedeagus of an Alberta specimen is as in the Fig. 108.

Geographical distribution. — The members of this species are known from Labrador (Frick, 1959) and western Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂, 1 ♀ Banff, 14.vii.1949, coll. E. H. Strickland; 1 ♀ George Lake, near Busby, University of Alberta field station, Malaise trap collection, 17-21.vi.1966, coll. P. Graham.

Phytomyza matricariae Hendel

Phytomyza matricariae Hendel, 1920:161; Spencer, 1969:254.

Comparison and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; dark scutellum; essentially dark femora; upper Ors shorter than lower; and with slight yellow on upper parts of mesopleura, humeral and notopleural areas. The adults resemble those of *P. spondylii* R.-D. but differ in having the second costal segment shorter, approximately three times the length of the fourth and distinct male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — In Alberta the larvae make linear mines in the leaves of *Achillea millefolium* L., *A. sibirica* Ledeb., *Chrysanthemum* sp. (cultivated), *Matricaria matricarioides* (Less.) Porter, and *Tanacetum vulgare* L., belonging to the family Compositae. Pupation occurs outside the mine. Detailed biology and host-plant relationships are discussed in a separate paper (Sehgal, 1971).

Geographical distribution. — The members of this species are known from Europe (Hendel, 1935) and Canada (Spencer, 1969). I examined numerous specimens bred from all hosts listed above from various localities around Edmonton.

Phytomyza mertensiae new species

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by dark frons; upper Ors shorter than lower; dark mesonotum and scutellum; essentially dark femora and pleura; and second costal segment less than three times length of fourth. The adults differ from those of the similar species, *P. prava* Spencer and *P. sehgalii* Spencer, in having darker frons and distinct male genitalia. This species is included in Spencer's (1969) key to Canadian species of the genus *Phytomyza* Fallén by amending and extending couplet 88 as below:

88. Third antennal article distinctly enlarged *nepetae* Hendel
 - Third antennal article small 88a
 88a. Frons paler, brownish above; acr strong *sehgalii* Spencer
 - Frons dark brown; acr normal; aedeagus as in Fig. 110, 111. *mertensiae* n. sp.

Description. — Head. Frons approximately two and a half times width of eye level of front ocellus, slightly projected in front of eye margin in profile. Mouth margin normal; lunule high. Two Ors, directed upwards, upper smaller than lower; two Ori, directed inwards and upwards, lower one weaker than upper; orbital setulae few, approximately six to seven, proclinate. Eyes oval, approximately 1.17 times higher than their length, bare; ocellar triangle small. Gena approximately 0.22 times vertical eye height. Third antennal article normal, rounded at tip; arista normal, pubescent.

Mesonotum. Dorsocentrals 3+1 strong bristles; acr in four irregular rows.

Wing. Length approximately 2.0 mm; costa extended to vein R₄₊₅; costal segments 2-4 in the ratio of 1 : 0.32 : 0.35; crossvein m-m absent.

Male genitalia (Fig. 109-112). Hypandrium (Fig. 109) small, V-shaped, with broad side

arms; pregonites broad; postgonites elongate; surstyli normal; aedeagus (Fig. 110, 111) complex as illustrated; ejaculatory apodeme (Fig. 112) broad, bulb small and membranous.

Colour. Frons, orbits, gena and lunule dark brown; ocellar triangle weakly shining black; antennae black; mesonotum, scutellum and pleura mat greyish black; coxae black; femora black, with yellow on distal tips; tibiae and tarsi dark brown; squamae yellow, fringe brown; halteres pale.

Derivation of the specific name. — This species is named after the generic name of its food plant.

Biology. — Larvae make linear mines in the leaves of *Mertensia paniculata* (Ait.) G. Don, family Boraginaceae. Pupation occurs outside the mine.

Geographical distribution. — The members of this species are known only from the type locality:

CANADA. Alberta: Holotype ♂ Edmonton, White Mud Creek park, from leaf mines on *Mertensia paniculata* (Ait.) G. Don, coll. 10.ix.1966, emerged 10.iii.1967; paratypes 1 ♀ same data; 1 ♂ same locality, 8.vi.1967.

Phytomyza merula Spencer

Phytomyza merula Spencer, 1969:254.

Comparison and diagnostic characters. — The members of this species differ from those of a very similar species, *gregaria* Frick, in having deeper gena, about one-half eye height and orbits in form of a broad ring below eyes. Spencer (1969) illustrated the distinctive aedeagus.

Geographical distribution. — Known only from Alberta, Canada from the following locality:

CANADA. Alberta: Jasper (Spencer, 1969).

Phytomyza milii Kaltenbach

Phytomyza milii Kaltenbach, 1864:248; Spencer, 1969:255.

Phytomyza intermedia Spencer; Griffiths, 1964:405.

Comparison and diagnostic characters. — The members of this species belong to the group characterized by dark frons; mat black mesonotum and scutellum; two equal Ors, black tarsi and second costal segment at least three times the length of the fourth. The adults resemble those of *P. involucratae* Spencer and can be reliably separated only by examination of male genitalia. The sclerotization of distiphallus varies in this species (Griffiths, 1964). The aedeagus of an Alberta specimen is as illustrated in Fig. 113. Griffiths (1964) illustrated the aedeagus of European and Faeroese specimens. Spencer (1969) also illustrated the aedeagus.

Biology. — Larvae probably mine the leaves of grasses (Gramineae) in Alberta.

Geographical distribution. — The members of this species are known from Europe, Iceland, Faeroes (Griffiths, 1964) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Banff, 3.ix.1966; 2 ♂♂ Jasper, 1-2.ix.1966; 3 ♂♂ Jasper, Mt. Edith Cavell, 1.ix.1966.

Phytomyza miranda Spencer

Phytomyza miranda Spencer, 1969:255.

Comparison and diagnostic characters. — The members of this species differ from those of

a similar species, *luteiceps* new species, in having black third antennal article. The elongate surstyli and aedeagus as figured by Spencer (1969) are quite distinct.

Geographical distribution. — The members of this species are known only from Alberta, Canada from the following locality:

CANADA. Alberta: Blairmore (Spencer, 1969).

Phytomyza misella Spencer

Phytomyza misella Spencer, 1969:256.

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; normal mouth margin and third antennal article; two equal Ors; essentially dark femora and pleura; acrostichals in two rows; and yellow fore-coxae. The adults differ from those of the similar species, *P. subtenella* Frost, by having frons less projected, narrower gena and distinct aedeagus. They also resemble those of *P. pedicularicaulis* Spencer and *P. jasperensis* new species but have entirely different male genitalia. The aedeagus of an Alberta specimen is illustrated (Fig. 114). Spencer (1969) also illustrated the aedeagus.

Geographical distribution. — The members of this species are known only from western Canada from the type locality (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 4 ♂♂ Jasper, 17.vi.1966.

Phytomyza multifidae new species

Comparisons and diagnostic characters. — The members of the species belong to the group characterized by dark frons; two equal Ors; brilliantly shining black mesonotum, scutellum and pleura; and second costal segment less than three times length of fourth. The members of this species were included in Spencer's (1969) key to Canadian species of the genus *Phytomyza* Fallén at couplet 61 as *Phytomyza* sp. (Sehgal). This couplet is amended as below:

61. Orbits normal in width; only fore knees yellowish *canadensis* Spencer
 - Orbits broad; knees variable from yellow to almost dark; wing base yellow; aedeagus as in Fig. 116 *multifidae* n. sp.

Description. — Head. Frons approximately 1.6 times width of eye at level of front ocellus, not projected in front of eye margin in profile. Mouth margin normal; lunule low. Two Ors, directed upwards, equal in size; two Ori, directed inwards, the lower one smaller than upper; orbital setulae few, approximately seven to eight, proclinate. Eyes almost circular, approximately 1.1 times higher than their length, bare; ocellar triangle small. Gena approximately one-third vertical eye height. Third antennal article rounded at tip, with normal pubescence; arista normal, pubescent.

Mesonotum. Dorsocentrals 3+1 strong bristles; acr in three to four irregular rows.

Wing. Length 1.5-1.6 mm; costa extended to vein R_{4+5} ; costal segments 2-4 in the ratio of 1 : 0.33 : 0.66; crossvein m-m absent; M_{3+4} at wing tip.

Male genitalia (Fig. 115-117). Hypandrium (Fig. 115) small, V-shaped; pregonites broad; postgonites elongate; surstyli normal; aedeagus (Fig. 116) complex, as illustrated; ejaculatory apodeme (Fig. 117) small, fan-shaped, bulb small, membranous.

Colour. Frons, orbits, gena and lunule dark; ocellar triangle shining black; antennae black; mesonotum, scutellum and pleura shining black; legs black; distal tips of femora in females bright yellow, but in male dark; wing base yellow; squamae and fringe pale; halteres bright

yellow.

Derivation of the specific name. — This species is named after the specific epithet of its food plant *Anemone multifida* Poir.

Biology. — Larvae make linear mines in the leaves of *Anemone multifida* Poir., family Ranunculaceae. Pupation occurs outside the mine.

Geographical distribution. — The members of this species are known only from the type locality:

CANADA. Alberta: Holotype ♂ Tolman bridge, Red Deer valley (badlands), from leaf mines on *Anemone multifida* Poir., coll. 14.vi.1969, emerged 8.vii.1969; paratypes 2 ♂♂ same locality and host, emerged 5.vii.1969; coll. G. C. D. Griffiths.

Phytomyza oxytropidis new species

Comparison and diagnostic characters. — The members of this species belong to the group characterized by dark frons; two equal Ors; normal third antennal article; mat greyish black mesonotum and scutellum; two rows of acrostichals; and dark tarsi. The adults resemble the member of *P. lupinivora* Sehgal from which they may be separated as shown below in extension to Spencer's (1969) key to Canadian species of the genus *Phytomyza* Fallén.

- | | | |
|------|--|---------------------------|
| 65. | Second costal section short; less than 1.25 times length of fourth | 65a |
| - | Second costal section longer, at least 1.5 times length of fourth | ♂♂ |
| 65a. | Second costal section approximately 1.25 times length of fourth; orbits dark | <i>lupinivora</i> Sehgal |
| - | Second costal section almost equal to fourth; orbits yellowish | <i>oxytropidis</i> n. sp. |

Description. — Head. Frons approximately twice width of eye at level of front ocellus, slightly projected in front of eye margin in profile. Two Ors equal in size, directed upwards; two Ori, lower one smaller than upper, directed inwards; orbital setulae few, six to seven, proclinate. Eyes oval, approximately 1.2 times higher than their length; ocellar triangle small. Third antennal article rounded at tip, with normal pubescence; arista normal, pubescent.

Mesonotum. Dorsocentrals 3+1 strong bristles; acr few, three to six scattered hairs.

Wing. Length in male 1.6 mm; costa extended to vein R_{4+5} ; costal segments 2-4 in the ratio of 1 : 0.5 : 0.93; crossvein m-m absent; M_{3+4} at wing tip.

Male genitalia (Fig. 118-120). Hypandrium (Fig. 118) with broad side arms and conspicuously long apodeme; pregonites broad; postgonites elongate and broad anteriorly; surstyli small, without any big spines; aedeagus (Fig. 119) with characteristic long spines between two long, darkly sclerotized arms of basiphallus; distiphallus separated by a small membranous section; ejaculatory apodeme (Fig. 120) broad, bulb small.

Colour. Frons, gena, lunule and antennae all black; orbits slightly yellowish in most specimens; ocellar triangle weakly shining black; legs black; mesonotum, scutellum and pleura mat greyish black.

Derivation of the specific name. — This species is named *oxytropidis* after the generic name of its food plant.

Biology. — Larvae make linear mines on the leaflets of *Oxytropis splendens* Dougl. and *O. campestris gracilis* (A. Nels), family Leguminosae. Pupation occurs inside the leaf mine.

Geographical distribution. — The members of this species are known only from the localities of its type specimens as below:

CANADA. Alberta: Holotype ♂ Jasper, 5 miles south of Athabasca Falls, from leaf mines on *Oxytropis splendens* Dougl., coll. 15.x.1967, emerged iv.1968; paratypes 1 ♂, 2 ♀♀ same

data. Yukon Territory: 1 ♂ Lake Laberge, from leaf mines on *Oxytropis campestris gracilis* (A. Nels.), coll. 9.viii.1968, emerged 20.v.1969, coll. G. C. D. Griffiths.

Phytomyza penstemonis Spencer

Phytomyza penstemonis Spencer, 1969:265.

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; dark scutellum; essentially dark femora and pleura; two equal Ors; acrostichals approximately three to four scattered hairs; and pale squamal fringe. The adults resemble those of *P. plantaginis* R.-D. and *P. colemanensis* new species but differ in having second antennal article black and distinct male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae make linear mines on the leaves of *Penstemon confertus* Dougl. and *P. procerus* Dougl., family Scrophulariaceae. Larvae pupate inside the leaf mine.

Geographical distribution. — The members of this species were previously known only from the locality of its type series from western Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♀ Blairmore, from leaf mines on *Penstemon confertus* Dougl., coll. 26.vi.1966, emerged 2.vii.1966; 1 ♂ Coleman, 27.vi.1966, 2 ♂♂, 3 ♀♀ Nevis, from leaf mines on *Penstemon procerus* Dougl., coll. 14.vi.1969, emerged 23-26.vi.1969, coll. G. C. D. Griffiths.

Phytomyza periclymeni de Meijere

Phytomyza periclymeni de Meijere, 1924:145.

Comparison and diagnostic characters. — The main distinguishing characters of the members of this species are: dark frons; normal third antennal article; two equal Ors; mat grey mesonotum, scutellum and pleura; dark tarsi; second costal segment less than three times the length of the fourth; and acrostichals in approximately four rows. The adults resemble those of *P. caprifoliae* Spencer and can be reliably separated only by examination of male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — In Alberta the larvae mine the leaves of *Lonicera involucrata* (Richards) Banks, family Caprifoliaceae.

Geographical distribution. — The members of this species are known from Europe (Hendel, 1935) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 4 ♂♂, 2 ♀♀ Edmonton, river bank, near University of Alberta campus, from leaf mines on *Lonicera involucrata* (Richards) Banks, coll. 26.vii.1966, emerged 15-16.viii.1966; 1 ♂ Elk Island park, 4.vi.1967; 2 ♂♂ St. Albert, near Edmonton, 14.vi.1966.

Phytomyza petasiti Spencer

Phytomyza petasiti Spencer, 1969:266.

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; dark scutellum; essentially dark femora; and mostly yellow pleura. The adults resemble those of *P. spondylii* R.-D. and *P. matricariae* Hendel and differ in having both Ors equal and distinct male genitalia. The aedeagus of this species has been illustrated by Spencer.

Biology. — Larvae make linear mines on the leaves of *Petasites sagittatus* (Pursh) A. Gray, family Compositae. Pupation occurs outside the mine.

Geographical distribution. — The members of this species are known only from Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♀ Devon botanical garden, University of Alberta, from linear mines on leaves of *Petasites sagittatus* (Pursh) A. Gray, coll. 28.vii.1966, emerged 13.iii.1967; 1 ♂ Elk Island park, same host, coll. 13.vii.1968, emerged viii.1968.

Phytomyza plantaginis R.-D.

Phytomyza plantaginis Robineau-Desvoidy, 1851:404.

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; two equal Ors; third antennal article elongate and with normal pubescence; essentially dark femora and pleura; and acrostichals usually few isolated hairs. The adults differ from those of the similar species, *P. syngenesiae* (Hardy), by having pale squamal fringe; shorter second costal segment, approximately 1.5 times length of fourth, and conspicuously yellow fore-coxae. They differ from those of other similar species, *P. penstemonis* Spencer and *P. colemanensis* new species, by having yellow second antennal article and distinct male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — In Alberta the larvae make linear mines in the leaves of *Plantago major* L., family Plantaginaceae. Pupation occurs inside the leaf mine.

Geographical distribution. — The members of this species are Holarctic in distribution, known from Europe, Australia, Japan, U. S. A. and Canada. I examined the following material from Alberta:

CANADA. Alberta: 1 ♀ Edmonton, river bed near University of Alberta campus, from leaf mines on *Plantago major* L., 26.vii-5.viii.1966; 4 ♀♀ George Lake near Busby, University of Alberta field station, coll. 21.viii.1966, emerged 25-31.viii.1966.

Phytomyza prava Spencer

Phytomyza prava Spencer, 1969:269.

Comparison and diagnostic characters. — The members of this species are distinctive in having frons which is basically yellow, but is conspicuously darkened. This species has therefore been included in both parts of the key having yellow frons and dark frons. Other diagnostic characters of the members of this species are: dark scutellum; dark femora and pleura and only one Ors. The adults resemble those of *P. mertensiae* new species, but differ in having yellowish frons and gena, and distinct male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae make dark blotch mines on the leaves of *Anemone canadensis* L., family Ranunculaceae. The leaf mine of this species was illustrated among undetermined mines in Fig. 531 (Spencer, 1969). Pupation occurs outside the mine.

Geographical distribution. — The members of this species were previously known from Canada only from the locality of its type series (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 2 ♂♂, 1 ♀ Edmonton, White Mud Creek park, from leaf mines on *Anemone canadensis* L. (Ranunculaceae), coll. 4.ix.1968, emerged 20.ix.1968; 8 ♂♂, 9 ♀♀ same locality and host, coll. 3.ix.1968, emerged 19-25.ix.1968, 26.v.1969 and 4.vi.1969, coll. G. C. D. Griffiths; 1 ♂ George Lake near Busby, University of Alberta field station, 21.vi.1966.

Phytomyza queribunda Spencer

Phytomyza queribunda Spencer, 1969:271.

Comparison and diagnostic characters. — The members of this species belong to the group characterized by dark frons; mat greyish mesonotum and scutellum; two Ors equal; dark tarsi; second costal segment less than three times length of fourth; and acrostichals in four rows. The adults resemble those of *P. caprifoliae* Spencer and *P. periclymeni* de Meijere but differ in having frons slightly paler above and entirely different male genitalia. Spencer (1969) illustrated the characteristic aedeagus of this species.

Geographical distribution. — The members of this species are known only from the type locality in Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ George Lake near Busby, University of Alberta field station, 7.vi.1968, coll. G. C. D. Griffiths.

Phytomyza ranunculi (Schrank)

Musca ranunculi Schrank, 1803:140.

Phytomyza flavoscutellata Fallén, 1823b:4.

Phytomyza albipes Meigen, 1830:195.

Phytomyza ranunculi (Schrank); Hendel, 1920:153, 1935:463; Frick, 1952:428, 1959:434; Spencer, 1969:271.

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; dark third antennal article and yellow scutellum. They differ from another species in this group, *P. clematiphaga* Spencer, by having the upper orbital bristle shorter than lower and distinct male genitalia.

The Alberta specimens from Elk Island park, bred from leaf mines on *Ranunculus abortivus* L., correspond in colour to the form *albipes* Meigen having yellow on mesonotum. One specimen from George Lake corresponds in colour to the form *flavoscutellata* Fallén having darker mesonotum.

The number of coils in the distiphallus vary from one coil in a Faeroes specimen (Griffiths, 1964) to eight coils in Alberta specimens. There are five coils in the European specimens illustrated by Nowakowski (1962). Besides, there is variation in the direction of coils, which in some specimens are coiled upwards, while in others downwards. The number of coils and their direction does not seem to be related to their external colour variations in this species as was pointed out by Griffiths (1964). However, it is possible that more than one species is involved in its entire range.

The male genitalia of this species are also very close to that of *P. vibeana* Griffiths, but the latter differs in having 11 coils in the distiphallus and dark mesonotum and scutellum.

Biology. — In Alberta the larvae make linear mines in the leaves of *Ranunculus abortivus* L., family Ranunculaceae. Pupation occurs outside the mine.

Geographical distribution. — The members of this species are Holarctic in distribution, known from Europe (Hendel, 1935), United States (Frick, 1959), Faeroes, Iceland and Greenland (Griffiths, 1966), Japan (Sasakaw, 1961) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 10 ♂♂, 6 ♀♀ Elk Island park, from linear mines in the leaves of *Ranunculus abortivus* L., coll. 22.v.1969, emerged 5-8.vi.1969, coll. G. C. D. Griffiths; 1 ♂ George Lake near Busby, University of Alberta field station, 21.vi.1966.

Phytomyza riparia new species

Comparisons and diagnostic characters. — A member of this species belongs to the group characterized by yellow frons; upper Ors shorter than lower; mouth margin normal; mat greyish mesonotum and scutellum; upper margins of mesopleura, humeral and notopleural areas yellow; essentially dark femora; and second costal segment approximately three and a half times length of fourth. The adult resembles that of *P. spondylii* R.-D., from which it may be separated as shown below in extension to Spencer's (1969) key to Canadian species of the genus *Phytomyza* Fallén:

13. Two Ors equal 14
 - Upper Ors shorter than lower or lacking 13a
 13a. Third antennal segment with normal pubescence; upper Ors sometimes lacking; aedeagus as illustrated (Spencer, 1969) *spondylii* R.-D.
 - Third antennal segment with conspicuously long pubescence; upper Ors present; aedeagus as in Fig. 121 *riparia* n. sp.

Description. — Head. Frons almost twice width of eye at level of front ocellus, only slightly projected in front of eye margin in profile. Mouth margin normal. Two Ors, upper shorter than lower, one side of holotype has only one Ors, directed upwards; two strong Ori, directed inwards; orbital setulae few, six to seven, proclinate. Eyes oval, approximately 1.2 times higher than their length, bare; ocellar triangle small. Gena approximately one-fourth of vertical eye height. Third antennal article rounded at tip, with conspicuously long pubescence; arista normal, pubescent.

Mesonotum. Dorsocentrals 3+1 strong bristles; acr in almost five irregular rows.

Wing. Length in male 2.0 mm; costa extended to vein R_{4+5} ; costal segments 2-4 in the ratio of 1 : 0.3 : 0.3; crossvein m-m absent.

Male genitalia (Fig. 121-122). Hypandrium with broad side arms and inconspicuous or small apodeme; pregonites broad; postgonites elongate; surstyli normal; aedeagus (Fig. 121) as illustrated with two long characteristic processes in the distiphallus; ejaculatory apodeme (Fig. 122) broad, bulb small.

Colour. Frons, orbits and gena yellow; both Vt's on dark ground; third antennal article dark brown; upper parts of mesopleura, humeral and notopleural areas yellow; mesonotum and scutellum mat greyish, slightly paler; coxae black; femora dark brown, with yellow on distal tips; tibiae and tarsi yellowish brown; squamae yellow, fringe brown; halteres yellow.

Derivation of the specific name. — This species is named *riparia* as its holotype was collected along the Saskatchewan River bank.

Geographical distribution. — The members of this species are known only from the type locality:

CANADA. Alberta: Holotype ♂ Edmonton, Saskatchewan River bank near University of Alberta campus, 20.vii.1966.

Phytomyza sehgalii Spencer

Phytomyza sehgalii Spencer, 1969:274.

Comparisons and diagnostic characters. — The members of this species differ from those of *mertensiae* new species in having paler frons and from *prava* Spencer in having strong acrostichals, small third antennal article and distinct male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — Known only from Alberta, Canada from the following locality:

CANADA. Alberta: Edmonton, White Mud Creek (Spencer, 1969).

Phytomyza senecionella new species

Comparison and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; two Ors equal; dark scutellum; essentially dark femora and pleura; normal mouth margin and third antennal article; acrostichals only two to three scattered hairs; dark squamal fringe and fore-coxae. The adults resemble those of the similar species, *P. syngenesiae* (Hardy), and males of the two can be separated reliably only by examination of the genitalia. This species is included in Spencer's (1969) key to Canadian species of the genus *Phytomyza* Fallén as below:

40. Second costal section short; 1.5 times length of fourth; third antennal segment enlarged; squamal fringe pale 41
 - Second costal section longer, approximately twice length of fourth; third antennal segment normal; squamal fringe dark 40a
 40a. Aedeagus as illustrated (Spencer, 1969) *syngenesiae* (Hardy)
 - Aedeagus as in Fig. 123 *senecionella* n. sp.

Description. — Head. Frons wider than width of eye at level of front ocellus (1 : 0.55), very slightly projected in front of eye margin in profile. Two Ors equal, directed upwards; one strong Ori and one small hair present below directed inwards; orbital setulae few, six to seven, proclinate. Eyes almost circular, their vertical height being almost equal to their length, bare; ocellar triangle small. Gena deep, approximately two-fifths of eye height. Antennal bases approximate; third antennal article rounded at tip, with normal pubescence; arista normal and pubescent.

Mesonotum. Dorsocentrals 3+1 strong bristles; acr two to three scattered hairs.

Wing. Length in male 2.75 mm; costa extended to vein R_{4+5} ; costal segments 2-4 in ratio of 1 : 0.3 : 0.56; crossvein m-m absent; vein M_{3+4} at wing tip.

Male genitalia. (Fig. 123-124). Hypandrium with side arms broad and no conspicuous apodeme; pregonites broad; postgonite with small hook anteriorly; surstyli small and normal; aedeagus (Fig. 123) as illustrated; ejaculatory apodeme (Fig. 124) slightly broad, bulb small and membranous.

Colour. Frons, orbits and gena yellow; both Vt's on dark grounds; all antennal articles black; ocellar triangle shining black; mesonotum, scutellum and pleura mat grey; legs black, only tips of femora with slight yellow, coxae black; squamae yellow, fringe dark; halteres yellow.

Derivation of the specific name. — This species is named after the generic name of its food plant.

Biology. — Larvae make broad linear mines on the leaves of *Senecio congestus* var. *palustris* (L.), family Compositae. The leaf mines were more or less communal with more than one larva feeding in them. Pupation occurs usually at the leaf bases or sometimes on the stem.

Geographical distribution. — The members of this species are known only from the type locality:

CANADA. Alberta: Holotype ♂ Elk Island park, from leaf mines on *Senecio congestus palustris* (L.), coll. 2.vii.1969, emerged 6.vii.1969; paratypes 2 ♂♂ same locality and host, emerged 6-12.vii.1969, coll. G. C. D. Griffiths.

Phytomyza solidaginivora Spencer

Phytomyza solidaginivora Spencer, 1969:274.

Comparison and diagnostic characters. — The members of this species differ from those of similar species, *matricariae* Hendel, in having dark second antennal article and distinct male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae make linear leaf mines on *Solidago*, family Compositae.

Geographical distribution. — Known only from Alberta, Canada from the following locality:

CANADA. Alberta: Edmonton, University of Alberta campus (Spencer, 1969).

Phytomyza solidaginophaga new species

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; two equal Ors; normal third antennal article; dark scutellum; mostly dark femora and pleura; and three to six rows of acrostichals. The adults resemble those of *P. aquilegiana* Frost and *P. aquilegioides* new species but differ in having the frons slightly darkened below and distinct male genitalia. They also resemble those of another similar species, *P. ilicis* Curtis, and may be separated as shown below in extension to Spencer's (1969) key to Canadian species of the genus *Phytomyza* Fallén:

32. Frons distinctly darkened, either above or below 32a
 - Frons entirely pale, yellow or orange, at most orbits dark 33
 32a. Aedeagus as illustrated (Spencer, 1969); larva leaf-miner in *Ilex* *ilicis* Curtis
 - Aedeagus as in Fig. 126; larva leaf-miner in *Solidago* *solidaginophaga* n. sp.

Description. — Head. Frons approximately twice eye width at level of front ocellus, slightly projected in front of eye margin in profile. Mouth margin normal; lunule low. Two equal Ors, directed upwards (one specimen has only one Ors, but has two bristles in the same socket as upper Ori; two Ors have therefore been considered as normal for the members of this species). Two Ori, directed inwards, lower one weaker than upper; orbital setulae few, approximately seven, proclinate. Eyes oval, approximately 1.2 times higher than their length, bare; ocellar triangle small. Gena approximately 0.28 times vertical height of eye. Third antennal article rounded at tip, with normal pubescence; arista normal, pubescent.

Mesonotum. Dorsocentrals 3+1 strong bristles; acr in approximately four irregular rows.

Wing. Length in male approximately 2.1 mm; costa extended to vein R_{4+5} ; costal segments 2-4 in ratio of 1 : 0.26 : 0.3; crossvein m-m absent.

Male genitalia (Fig. 125-127). Hypandrium (Fig. 125) V-shaped, with broad side arms; pregonites broad; postgonites elongate; surstyli normal; aedeagus (Fig. 126) with characteristic row of small spines between two long arms of basiphallus, as illustrated; ejaculatory apodeme (Fig. 127) small, bulb small and membranous.

Colour. Frons yellow, slightly darkened just above lunule; orbits slightly darkened along eye margins; lunule and gena darkened; ocellar triangle weakly shining black; both Vt's on dark ground; antennae black; mesonotum, scutellum and pleura mat greyish black; femora black, with yellow distal tips; tibiae and tarsi dark brown; squamae yellow, fringe brown; halteres yellow.

Derivation of the specific name. — This species has been named after the generic name of its food plant.

Biology. — Larvae make linear mines in the leaves of *Solidago lepida* DC, family Compositae. Pupation occurs outside the mine.

Geographical distribution. — The members of this species are only known from the type

locality:

CANADA. Alberta: Holotype ♂ George Lake near Busby, University of Alberta field station, from mines on the leaves of *Solidago lepida* DC, coll. 7.vi.1968, emerged 30.iv.1969, coll. G. C. D. Griffiths; paratype 1 ♂ same data.

Phytomyza spondylii R.-D.

Phytomyza spondylii Robineau-Desvoidy, 1851:147.

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; dark scutellum; and essentially dark femora. The colour of the upper margins of the mesopleura, humeral and notopleural areas is variable from yellow to almost dark. A small upper Ors is usually present. The adults having yellow on the sides resemble those of *P. matricariae* Hendel and differ in having the second costal section longer, approximately 3.5 times the fourth and dark second antennal article. The darker forms resemble those of *P. asterophaga* Spencer but differ in having entirely different male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae make linear mines in the leaves of *Heracleum lanatum* Michx., family Umbelliferae. Pupation occurs outside the mine.

Geographical distribution. — The members of this species are known from Europe (Hendel, 1935) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 2 ♂♂, 2 ♀♀ Edmonton, White Mud Creek park, from leaf mines on *Heracleum lanatum* Michx., emerged 18-19.vii.1966.

Phytomyza subalpina new species

Comparisons and diagnostic characters. — A member of this species belongs to the group characterized by yellow frons; normal mouth margin and third antennal article; two Ors equal; dark scutellum; essentially dark femora and pleura; acrostichals in two rows; and dark fore-coxae. The adult resembles that of *P. fuscula* Zetterstedt but differs in having a pale squamal fringe and distinct male genitalia. It differs from another similar species, *P. atripalpis* Aldrich, as shown below in extension to Spencer's (1969) key to Canadian species of the genus *Phytomyza* Fallén:

- | | | |
|------|---|---------------------------|
| 53. | Second costal section short, less than twice length of fourth | 53a |
| - | Second costal section longer, twice length of fourth. | <i>gelida</i> Spencer |
| 53a. | Gena two-fifths eye height | <i>atripalpis</i> Aldrich |
| - | Gena one-fifth eye height. | <i>subalpina</i> n. sp. |

Description. — Head. Frons approximately twice width of eye at level of front ocellus; mouth margin normal; lunule low. Two equal Ors directed upwards; two Ori, lower one weaker, both directed inwards; orbital setulae four to five, proclinate. Eyes oval, their vertical height being approximately 1.3 times their length, bare; ocellar triangle small. Gena approximately one-fifth vertical eye height. Third antennal article rounded at tip, with normal pubescence; arista normal, pubescent.

Mesonotum. Dorsocentrals 3+1 strong bristles; acr approximately nine hairs, in two rows.

Wing. Length in male approximately 2.1 mm; costa extended to vein R_{4+5} ; costal segments 2-4 in ratio of 1 : 0.35 : 0.65; crossvein m-m absent.

Male genitalia (Fig. 128-132). Hypandrium (Fig. 128) U-shaped with broad side arms; pregonites broad; postgonites (Fig. 129) elongate, with hook-like process anteriorly; surstyli normal; aedeagus (Fig. 130, 131) as illustrated; ejaculatory apodeme (Fig. 132) small, bulb membranous.

Colour. Frons, gena and lunule yellow; orbits yellow, slightly darkened near upper Ors; ocellar triangle weakly shining black; both Vt's on dark ground; antennae black; mesonotum, scutellum and pleura mat grey; femora, tibiae and tarsi black; squamal fringe dirty pale, squamae pale; halteres yellow.

Derivation of the specific name. — This species is named *subalpina* as its holotype was collected in the subalpine zone of foothills of Rocky Mountains.

Geographical distribution. — This species is known only from the type locality: CANADA. Alberta: Holotype ♂ Coleman, 27.vi.1966.

Phytomyza subtenella Frost

Phytomyza subtenella Frost, 1924:89.

Comparison and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; normal mouth margin and third antennal article; usually two equal Ors (but one specimen has three equal Ors); essentially dark femora and pleura; acrostichals in two well-defined rows and yellow fore-coxae.

The adults, wing length approximately 2.5 mm, differ from those of the similar species, *P. jasperensis*, in having the frons strongly projected in front of eye margin; gena deeper, approximately two-thirds of eye height and distinct male genitalia. The paraphalli in Alberta specimen were independent of the basiphallus and not joined as it appears from Spencer's (1969) illustration in which they are overlapping.

Geographical distribution. — The members of this species are known from the United States (Frick, 1959) and Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂ Banff, 28.vi.1966, 5 ♂♂ Hinton, 23.vii.1967; 1 ♂ Jasper, 17.vi.1966.

Phytomyza subtilis Spencer

Phytomyza subtilis Spencer, 1969:276.

Comparison and diagnostic characters. — The members of this species differ from those of a very similar species, *urbana* Spencer, in having darker grey mesonotum and slightly brownish frons. The male genitalia as figured by Spencer (1969) are, however, very distinct.

Biology. — Larvae make blotch mines on the leaves of *Lathyrus ochroleucus* Hook., family Leguminosae.

Geographical distribution. — Known from Alaska and Alberta. The Alberta locality is as follows:

CANADA. Alberta: Wabamun Lake (Spencer, 1969).

Phytomyza syngenesiae (Hardy)

Chromatomyia syngenesiae Hardy, 1849:391.

Phytomyza chrysanthemi Kowarz, 1891:243; Smulyan, 1914:21.

Phytomyza atricornis Meigen *sensu* Hendel, 1920:162 (in part); Frost, 1924:68; Frick, 1952:424, 1959:425 (*nomen dubium*).

Phytomyza syngenesiae (Hardy); Griffiths, 1967:7; Spencer, 1969:278.

Comparisons and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; dark scutellum; mostly dark femora and pleura; two Ors equal; normal third antennal article; and acrostichals normally lacking or at most three

to four isolated hairs present. The adults resemble closely those of an Old World species, *P. horticola* Goureau, and can be separated reliably only by examination of the male genitalia. Griffiths (1967) and Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae make linear mines in the leaves of numerous Compositae and rarely on non-Compositae hosts (Griffiths, 1967). In Alberta the flies have been bred from only two host-plants of the family Compositae, *Senecio* sp. (Spencer, 1969) and *Crepis gracilis* (D.C. Eat.) Rydb.

Geographical distribution. — The members of this species are widespread in Europe, Australia, New Zealand, U. S. A. and Canada (Griffiths, 1967). I examined the following material from Alberta:

CANADA. Alberta: 1 ♂, 2 ♀♀ Edmonton, University of Alberta campus, from leaf mines on *Crepis gracilis* (D.C. Eat.) Rydb., coll. 4.vi.1966.

Phytomyza thalictrivora Spencer

Phytomyza thalictrivora Spencer, 1969:279.

Comparison and diagnostic characters. — The members of this species belong to the group characterized by dark frons, mesonotum and scutellum; essentially dark femora and pleura; upper Ors lacking; and second costal segment less than three times length of fourth. The adults resemble those of *P. aquilegiovora* Spencer but differ in having darker frons and few acrostichals. They also resemble those of *P. minuscula* Goureau, but possess distinct male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Biology. — Larvae make linear mines on the leaves of *Thalictrum venulosum* Trel., family Ranunculaceae. Pupation occurs outside the mine.

Geographical distribution. — The members of this species are known only from Canada (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta 1 ♂ Edmonton, White Mud Creek park, from leaf mines on *Thalictrum venulosum* Trel., coll. 12.vi.1966, emerged 17.vi.1966; 1 ♂ Edmonton, Rainbow Valley, 31.v.1969.

Phytomyza timida Spencer

Phytomyza timida Spencer, 1969:279.

Comparison and diagnostic characters. — The members of this species belong to the group characterized by yellow frons; dark scutellum; and essentially dark femora and pleura. Spencer (1969) includes this species among those having upper orbital bristle shorter than lower. This character is probably variable as the Alberta specimens examined had both upper orbital bristles almost equal. The aedeagus of a specimen from Banff, Alberta is illustrated (Fig. 133) and agrees with that figured by Spencer (1969).

Geographical distribution. — The members of this species are known from Canada only from the locality of its type series (Spencer, 1969). I examined the following material from Alberta:

CANADA. Alberta: 2 ♂♂ Banff, 18.vi.1966; 1 ♂ Jasper, 16.vi.1966.

Phytomyza urbana Spencer

Phytomyza urbana Spencer, 1969:281.

Comparison and diagnostic characters. — The members of this species differ from those of a similar species, *subtilis* Spencer, in having paler greyish mesonotum and paler frons and

distinct male genitalia. Spencer (1969) illustrated the aedeagus characteristic of this species.

Geographical distribution. — Known only from Alberta, Canada from the following locality:

CANADA. Alberta: Blairmore (Spencer, 1969).

Phytomyza sp. (*Angelica arguta* Nutt.)

Comparison and diagnostic characters. — The distinguishing characters of the female of this species are: yellowish brown frons; wing length 2.5 mm; second costal segment three times length of fourth; dark squamal fringe; dark mesonotum, scutellum, pleura and femora and acrostichals in two to three rows. It resembles the adults of *P. aralivora* Spencer but has entirely different biology. This species cannot be definitely determined at present as no males are available for examination.

Biology. — Larvae make linear mines in the leaves of *Angelica arguta* Nutt., family Umbelliferae.

Geographical distribution. — The members of this species were examined only from southwestern Alberta as below:

CANADA. Alberta: 1 ♀ Blairmore, from leaf mines on *Angelica arguta* Nutt., coll. 5.ix. 1966, emerged 10.iii.1967; numerous leaf mines, same locality.

INSECT HOST-PLANT RELATIONSHIP IN THE FAMILY AGROMYZIDAE

The members of the family Agromyzidae are exclusively internal plant feeders during their larval stage. Larval feeding results in a definite pattern called the mine, and the study of the mining habits is called minology or hyponomology (Hering, 1951).

The agromyzid mines fall into two general categories. First, the epidermal leaf mines, in which the mining larva feeds only inside the epidermal layer of the leaf. These are restricted mainly to the old world tropics. The second, the parenchymal mine, in which the larva feeds on the parenchymatous tissue inside the leaf or other part of the plant. The majority of mines belong in this category. Leaf mines are usually seen externally and generally are more visible from one side than the other. Surface mines on other parts of a plant can also be detected as whitish or greenish channels with faecal granules distributed in definite tracks. Mines inside the stem or root are not easily detected, however, the injury caused by the mining larva can be seen by breaking the injured plant part. The shape of the larval mine is usually constant within the species, but varies between species. This helps greatly in the separation of closely related species which cannot otherwise be reliably identified by adult morphology. Hering (1951) dealt with shapes of mines made by mining insects and later, in 1957, illustrated the mines of European species in detail.

The relationship between the endophagous larvae of mining insects and their food plants is typically parasitic in nature. However, modern parasitology as a science does not concern itself with the study of such relationships. Nowakowski (1962) commenting on this situation proposed the term "zoophytoparasitology" for the study of animals as parasites and plants as hosts. The most important features of this relationship in the family Agromyzidae are the active choice of host-plant by the mining insect, the varying degree of host-plant specificity, and the adaptations of the maggot for an endoparasitic life in the semi-liquid environment of the leaf parenchyma. The understanding of this relationship is of great importance in dealing with the systematics of this group as it permits the use of the host-parasite discrimination method. It provides valuable information for identification of similar species, which cannot be separated on adult morphological characteristics alone.

Hering (1951) discussed the distribution of leaf mining species on plants of various families and examined the established phylogenetic relationships between the plant families in a system based on serum diagnosis alone as proposed by Mez (1926). Mez's system of classification has now been criticized by modern botanists because of similar serum reactions obtained for certain plant families which clearly are not closely related.

Table 2 lists the known local host-plants for the Albertan species. It is realized that the information on host-plants is not adequate for all species, but some useful observations can still be made. The arrangement of plant families is after the supposedly phylogenetic system of Takhtajan (1969). The phylogenetic relationships between plant families and orders is still a matter of controversy. Most plant classifications fall into two groups depending on the supposed nature of the primitive angiosperm flower (Davis and Heywood, 1965). One group is based on the assumption that the earliest angiosperms were wind pollinated and that the monocotyledons and dicotyledons have arisen independently from unknown gymnosperms. According to the second group of systems, dicotyledons and monocotyledons were both derived from primitive angiosperms which were insect-pollinated. Such a view is supported by many recent workers (Eames, 1961; Hutchinson, 1964; Takhtajan, 1969). Hutchinson (1964) in his revised edition of classification of angiosperms maintained a basic division of dicotyledons into woody "Lignosae" and herbaceous "Herbaceae," a system which allegedly leads to wide separation of certain plant families which are markedly similar in the structure of their flowers. In the absence of established phylogenies of both angiosperms and agromyzid parasites, it is difficult to study the trends in their coevolution.

It is generally accepted that the larvae of Cyclorrhapha were primitively saprophagous from which various specialized feeding habits like phytophagy, carnivory and parasitism have been derived (Hennig, 1952).

The dominance of agromyzids on angiosperm hosts suggest that angiosperms were well established as flowering plants before the agromyzids made their appearance. Although opinions differ as to precisely when angiosperms first appeared on the evolutionary scene, there is a general agreement that they came into prominence suddenly during the late Cretaceous (Eames, 1961). Hennig (1965) reviewed all supposed records of agromyzid fossils and concluded that the family Agromyzidae is not yet known to be represented in the Tertiary Baltic amber. In fact there are so far no fossils which can be definitely referred to the family. The occurrence of a large number of closely related and poorly differentiated species and their abundance on hosts belonging to highly evolved plant families suggests that much of the diversification of the family Agromyzidae is relatively recent. However, the possibility that the group goes back to late Cretaceous as suggested by Nowakowski (1962) must be admitted.

The recent use of male genitalia in agromyzid taxonomy has split many groups originally supposed to be polyphagous or oligophagous species, into species with much narrower host-plant specificity. It is becoming increasingly apparent that the majority of agromyzid species are restricted feeders, being monophagous or oligophagous. Strict monophagy also appears to be rare unless it results from a plant genus being monotypic. Nowakowski (1962) discussed the subject of host-plant specificity among the European species and revealed many examples where the original wide host range was found to be the result of misidentifications or assemblage of many species under the same name. The most polyphagous species, *Phytomyza syngenesiae* (Hardy), appears to be a restricted feeder in Alberta and has been bred from only two plant genera *Crepis* and *Senecio* of the family Compositae. This species is known from many Compositae and rarely from other host-plants (see Frick, 1959 as *Phytomyza atricornis* Meigen; Griffiths, 1967).

Most agromyzid genera occurring on species of monocot families are also represented on

various dicotyledons. The few exceptions are the species of the genus *Cerodontha* Rondani occurring only on monocot families Graminae, Cyperaceae, and Juncaceae; and the members of the *ambigua/nigripes* groups of the genus *Agromyza* Fallén which feed only on grasses. The species in these groups are uniform in external morphology of adults and in the general shape of the male genitalia, and probably represent early specialization of their feeding habit. Various species of the agromyzid genera *Liriomyza* Mik and *Phytomyza* Fallén feeding on grasses will probably prove to be oligophagous. The oligophagy of various grass-mining species has not been investigated because of the problems of identification of grasses at the time the mining larvae are collected.

The family Ranunculaceae is selected by members of the agromyzid genera *Melanagromyza* Hendel, *Ophiomyia* Brachnikov and *Phytomyza* Fallén. *Melanagromyza actaeae* n. sp. feeding inside the stems of *Actaea rubra* (Ait.) Willd and an *Ophiomyia* sp. making surface mines below the stem epidermis of *Thalictrum venulosum* Trel. appear to be specialized monophagous species. There are many closely related and poorly differentiated *Phytomyza* species feeding on the plant genera *Aquilegia* and *Thalictrum*, some of which are oligophagous species feeding on both. The species of the genus *Phytomyza* Fallén feeding on the plant genera *Clematis*, *Delphinium* and *Ranunculus* are specialized monophagous species. Three local species of the plant genus *Anemone* support three different leaf miners of the genus *Phytomyza* Fallén. The members of the agromyzid genera *Agromyza* Fallén, *Melanagromyza* Hendel and *Hexomyza* Enderlein feeding on Ulmaceae, Urticaceae and Salicaceae are all specific feeders. Two species known to have rosaceous host-plants in Europe and the United States have not yet been discovered on Alberta hosts. One is a specific cambium miner, *Phytobia amelanchieris* (Greene), feeding on *Amelanchier canadensis* (L.) (Frick, 1959), and the other *Agromyza spiraceae* Kaltenbach, an oligophagous species feeding on various genera of the subfamily Rosoideae in Europe. Members of the family Leguminosae are fed on by the representatives of the agromyzid genera *Agromyza* Fallén, *Liriomyza* Mik and *Phytomyza* Fallén. Most of these species are monophagous in Alberta, with the exception of *Liriomyza fricki* Spencer which is oligophagous. The plant families Cornaceae, Araliaceae, Umbelliferae and Elaeagnaceae are fed on by specific feeders of the agromyzid genera *Melanagromyza* Hendel, *Phytomyza* Fallén and *Amauromyza* Hendel. Members of the plant family Caprifoliaceae support oligophagous species belonging to the agromyzid genera *Paraphytomyza* Enderlein and *Phytomyza* Fallén. The oligophagous species feed on the plant genera *Lonicera* and *Symphoricarpos*. The plant families Boraginaceae, Scrophulariaceae; Plantaginaceae and Labiatae have specialized specific feeders. The family Compositae supports a highly specialized agromyzid fauna belonging to the genera *Melanagromyza* Hendel, *Ophiomyia* Brachnikov, *Liriomyza* Mik, *Calycomyza* Hendel, *Nemorimyza* Frey and *Phytomyza* Fallén. Most of these species are specific monophagous feeders. However, some oligophagous species feed on the plant genera *Crepis*, *Taraxacum*, and *Sonchus*; others feed upon members of tribe Anthemideae of the family Compositae, as shown by the host range of *Phytomyza matricariae* Hendel and *Liriomyza millefolii* Hering.

Table 2. Albertan host-plant records of Albertan agromyzid species.

DICOTYLEDONS

Family Ranunculaceae

<i>Actaea rubra</i> (Ait.) Willd	<i>Melanagromyza actaeae</i> n. sp.
<i>Anemone canadensis</i> L.	<i>Phytomyza prava</i> Spencer
<i>Anemone multifida</i> Poir.	<i>Phytomyza multifidae</i> n. sp.
<i>Anemone riparia</i> Fern.	<i>Phytomyza canadensis</i> Spencer
<i>Aquilegia</i> sp. (cultivated var.)	<i>Phytomyza aquilegiana</i> Frost, <i>P. aquilegio-</i> <i>phaga</i> Spencer, <i>P. aquilegivora</i> Spencer, <i>P. columbinae</i> n. sp.
<i>Clematis verticillaris</i> DC	<i>Phytomyza clematiphaga</i> Spencer
<i>Delphinium</i> sp. (cultivated)	<i>Phytomyza delphinivora</i> Spencer
<i>Ranunculus abortivus</i> L.	<i>Phytomyza ranunculi</i> (Schrank)
<i>Thalictrum venulosum</i> Trel.	<i>Phytomyza aquilegioides</i> n. sp., <i>P. columbinae</i> n. sp., <i>P. thalictrovora</i> Spencer, <i>Ophiomyia</i> sp.
<i>Thalictrum</i> sp.	<i>Phytomyza aquilegiana</i> Frost

Family Ulmaceae

<i>Ulmus americana</i> L.	<i>Agromyza aristata</i> Malloch
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Family Urticaceae

<i>Urtica gracilis</i> Ait.	<i>Melanagromyza martini</i> Spencer, <i>Phytomyza</i> sp., <i>luteiceps</i> n. sp.
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Family Salicaceae

<i>Populus tremuloides</i> Michx.	<i>Agromyza populoides</i> Spencer, <i>Hexomyza schineri</i> (Giraud), <i>Paraphytomyza</i> sp.
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Family Rosaceae

<i>Potentilla</i> sp.	<i>Agromyza</i> sp.
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Family Leguminosae

<i>Lathyrus ochroleucus</i> Hook.	<i>Liriomyza fricki</i> Spencer, <i>Liriomyza lathyri</i> n. sp., <i>Phytomyza subtilis</i> Spencer
<i>Lupinus sericeus</i> Pursh	<i>Phytomyza lupini</i> Sehgal, <i>P. lupinivora</i> Sehgal
<i>Oxytropis splendens</i> Dougl.	<i>Phytomyza oxytropidis</i> n. sp.
<i>Trifolium repens</i> L.	<i>Liriomyza fricki</i> Spencer
<i>Vicia americana</i> Muhl.	<i>Liriomyza fricki</i> Spencer, <i>L. viciae</i> Spencer

Family Cornaceae

<i>Cornus canadensis</i> L.	<i>Phytomyza agromyzina</i> Meigen
<i>Cornus stolonifera</i> Michx.	<i>Phytomyza agromyzina</i> Meigen

Family Araliaceae

<i>Aralia nudicaulis</i> L.	<i>Phytomyza aralivora</i> Spencer
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Family Umbellifereae

Angelica arguta Nutt.
Heracleum lanatum Michx.

Phytomyza sp.
Phytomyza spondylii R.-D.

Family Elaeagnaceae

Shepherdia canadensis (L.)

Amauromyza shepherdiae n. sp.

Family Caprifoliaceae

Lonicera dioica L.

Paraphytomyza lonicerae (R.-D.), *P. orbitalis*
 (Melander), *P. spenceri* n. sp.

Lonicera involucrata (Richards)

Paraphytomyza plagiata (Melander),
Phytomyza gregaria Frick, *P. periclymeni*
 de Meijere

Lonicera tartarica L.

Paraphytomyza lonicerae (R.-D.)

Symphoricarpos albus (L.)

Paraphytomyza lonicerae (R.-D.),
P. orbitalis (Melander)

Symphoricarpos occidentalis Hook.

Paraphytomyza spenceri n. sp.

Symphoricarpos sp.

Phytomyza caprifoliae Spencer

Family Rubiaceae

Galium boreale L.

Praspedomyza galiivora Spencer

Family Boraginaceae

Mertensia paniculata (Ait.)

Agromyza canadensis Malloch,
Phytomyza mertensiae n. sp.

Family Scrophulariaceae

Penstemon confertus Dougl.

Phytomyza penstemonis Spencer

Penstemon procerus Dougl.

Phytomyza penstemonis Spencer

Veronica sp. (cultivated)

Phytomyza crassiseta Zetterstedt

Family Plantaginaceae

Plantago major L.

Phytomyza plantaginis R.-D.

Family Labiatae

Mentha arvensis L.

Calycomyza menthae Spencer

Family Compositae

Achillea millifolium L.

Phytomyza matricariae Hendel

Achillea sibirica Ledeb.

Melanagromyza achilleana n. sp.,

Liriomyza millefolii Hering,

Phytomyza matricariae Hendel

Arnica cordifolia Hook

Phytomyza arnicivora n. sp.

Aster ciliolatus Lindl.

Phytomyza ciliolati Spencer

Aster conspicuus Lindl.

Phytomyza asterophaga Spencer

Bidens cernua L.

Melanagromyza bidenticola n. sp.

Chrysanthemum sp. (cult.)

Phytomyza matricariae Hendel

Crepis gracilis (D.C. Eat.) Rydb.

Phytomyza syngenesiae (Hardy)

Crepis tectorum L.

Phytomyza lactuca Frost

<i>Matricaria matricarioides</i> (Less.) Porter	<i>Phytomyza matricararum</i> Hendel
<i>Petasites sagittatus</i> (Pursh)	<i>Phytomyza petasiti</i> Spencer
<i>Senecio congestus palustris</i> (L.)	<i>Phytomyza senecionella</i> n. sp.
<i>Senecio pauciflorus</i> Pursh	<i>Liriomyza senecionivora</i> n. sp.
<i>Senecio</i> sp.	<i>Phytomyza syngenesiae</i> (Hardy)
<i>Solidago lepida</i> DC	<i>Phytomyza solidaginophaga</i> n. sp.
<i>Solidago</i> sp.	<i>Ophiomyia maura</i> (Meigen),
	<i>Calycomyza</i> ? <i>solidaginis</i> (Kaltenbach),
	<i>Nemorimyza posticata</i> (Meigen)
<i>Sonchus uliginosus</i> Bieb.	<i>Phytomyza lactuca</i> Frost
<i>Sonchus</i> sp.	<i>Calycomyza sonchi</i> Spencer
<i>Tanacetum vulgare</i> L.	<i>Liriomyza millefolii</i> Hering,
	<i>Phytomyza lactuca</i> Frost
<i>Taraxacum</i> sp.	<i>Calycomyza sonchi</i> Spencer

MONOCOTYLEDONS

Family Liliaceae

<i>Smilacina stellata</i> (L.)	<i>Liriomyza smilacinae</i> Spencer
<i>Maianthemum canadense</i> Desf.	<i>Liriomyza</i> sp.

Family Cyperaceae

<i>Scirpus</i> sp.	<i>Cerodontha (Dizygomyza) ? scirpi</i> (Karl)
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Family Gramineae

<i>Agropyron repens</i> (L.) Beauv.	<i>Cerodontha (Poemyza) incisa</i> (Meigen)
<i>Agropyron smithii</i> Rydb.	<i>Cerodontha (Poemyza) incisa</i> (Meigen)
<i>Deschampsia caespitosa</i> (L.)	<i>Liriomyza cordillerana</i> Sehgal
<i>Phalaris arundinacea</i> L.	<i>Cerodontha (Poemyza) incisa</i> (Meigen)
<i>Triticum aestivum</i> L.	<i>Cerodontha (Poemyza) superciliosa</i> (Zetterstedt)

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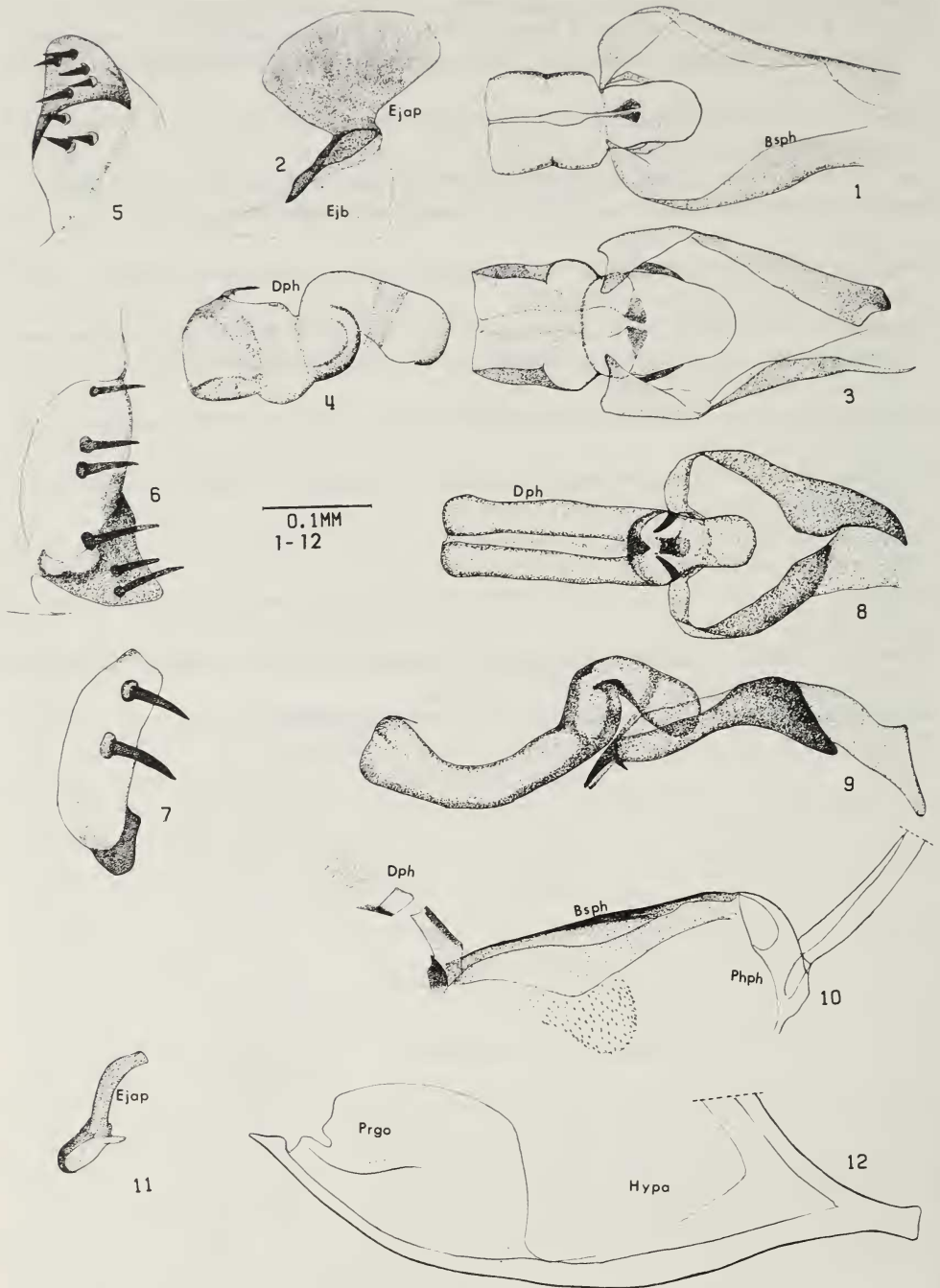


Fig. 1-2. *Agromyza albipennis*. 1. aedeagus, ventral view. 2. ejaculatory apodeme. Fig. 3-5. *A. brevispinata*. 3. aedeagus, ventral view. 4. distiphallus, lateral view. 5. surstylus. Fig. 6. *A. hockingi*, surstylus. Fig. 7. *A. ? hockingi*, surstylus. Fig. 8-9. *A. kincaidi*. 8. aedeagus, ventral view. 9. aedeagus, lateral view. Fig. 10-12. *A. nearctica*. 10. aedeagus, lateral view. 11. ejaculatory apodeme. 12. hypandrium.

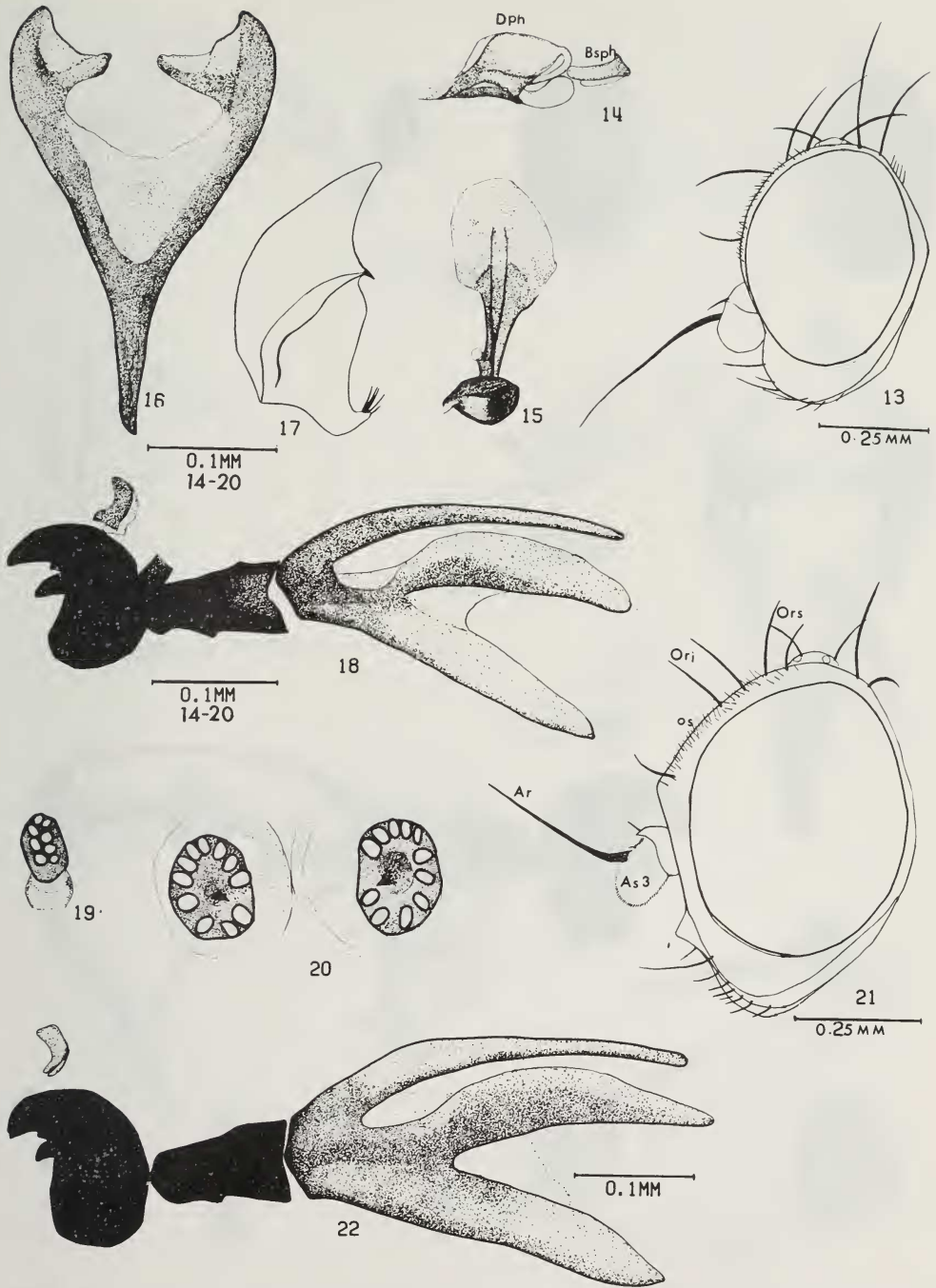


Fig. 13-20. *Melanagromyza achilleana*. 13. head, lateral view. 14. aedeagus, lateral view. 15. ejaculatory apodeme. 16. hypandrium. 17. surstylus. 18. cephalopharyngeal skeleton of larva. 19. anterior spiracle. 20. posterior spiracles. Fig. 21-22. *M. actaeae*. 21. head, lateral view. 22. cephalopharyngeal skeleton of larva.

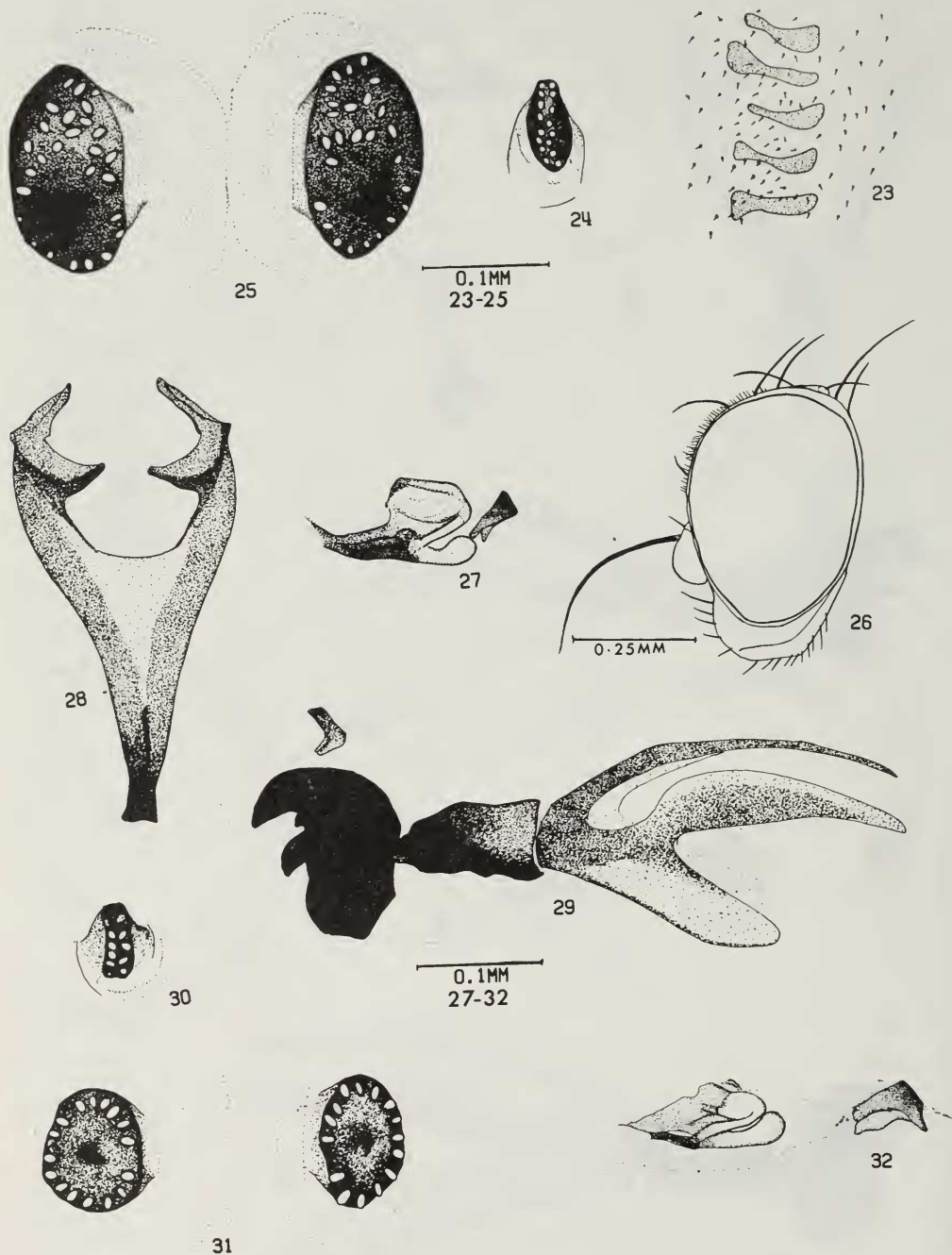


Fig. 23-25. *Melanagromyza actaeae*. 23. muscle scars and tubercle band from lateral portion of first abdominal segment of larva. 24. anterior spiracle. 25. posterior spiracles. Fig. 26-31. *M. bidenticola*. 26. head, lateral view. 27. aedeagus, lateral view. 28. hypandrium. 29. cephalopharyngeal skeleton of larva. 30. anterior spiracle. 31. posterior spiracles. Fig. 32. *Melanagromyza* sp. ?, aedeagus, lateral view.

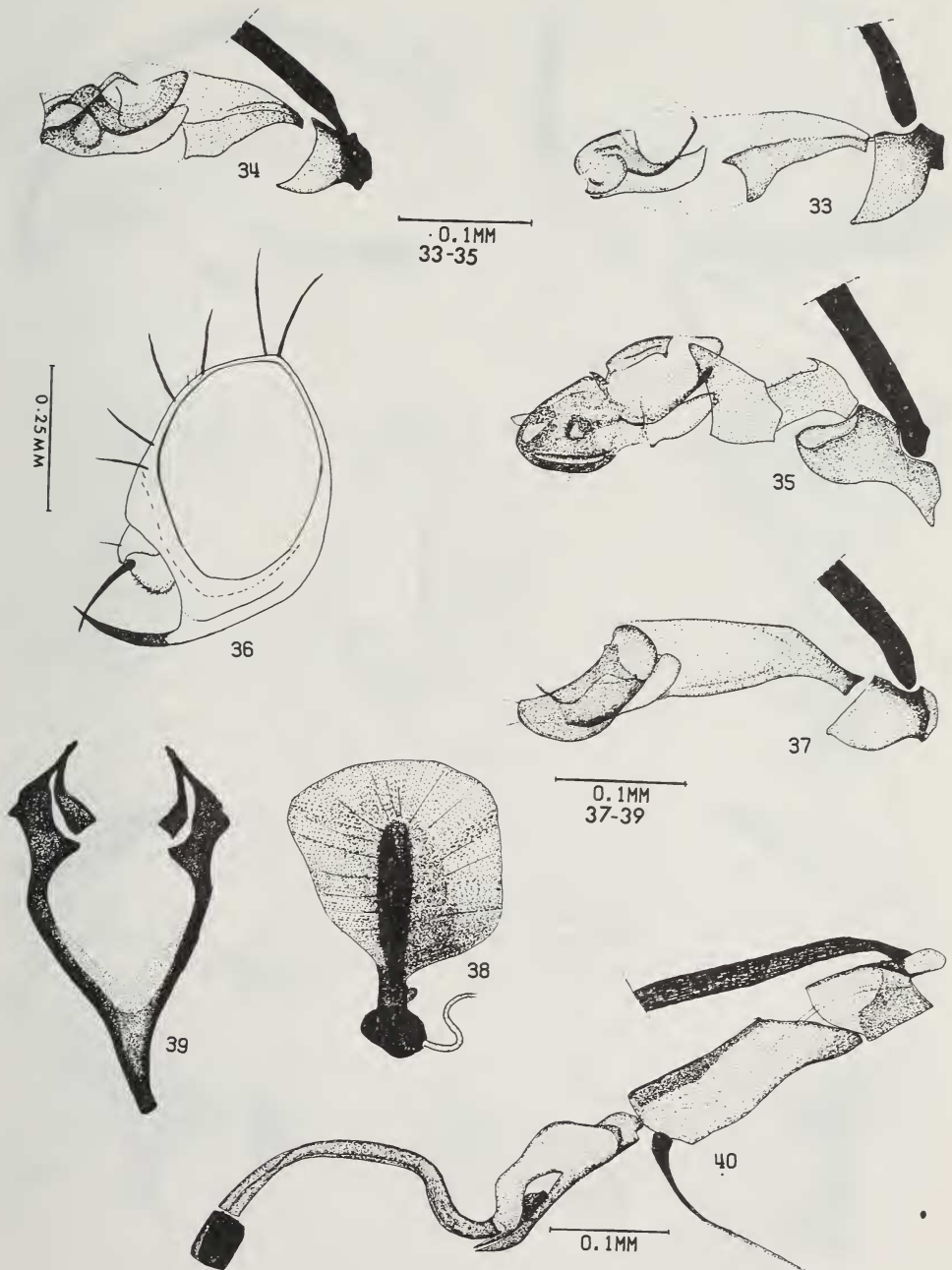


Fig. 33. *Ophiomyia labiatarium*, aedeagus, lateral view. Fig. 34. *O. maura*, aedeagus, lateral view. Fig. 35. *O. pulicaria*, aedeagus, lateral view. Fig. 36-39. *O. stricklandi*. 36. head, lateral view. 37. aedeagus, lateral view. 38. ejaculatory apodeme. 39. hypandrium. Fig. 40. *Cerodontha ? occidentalis*, aedeagus, lateral view.

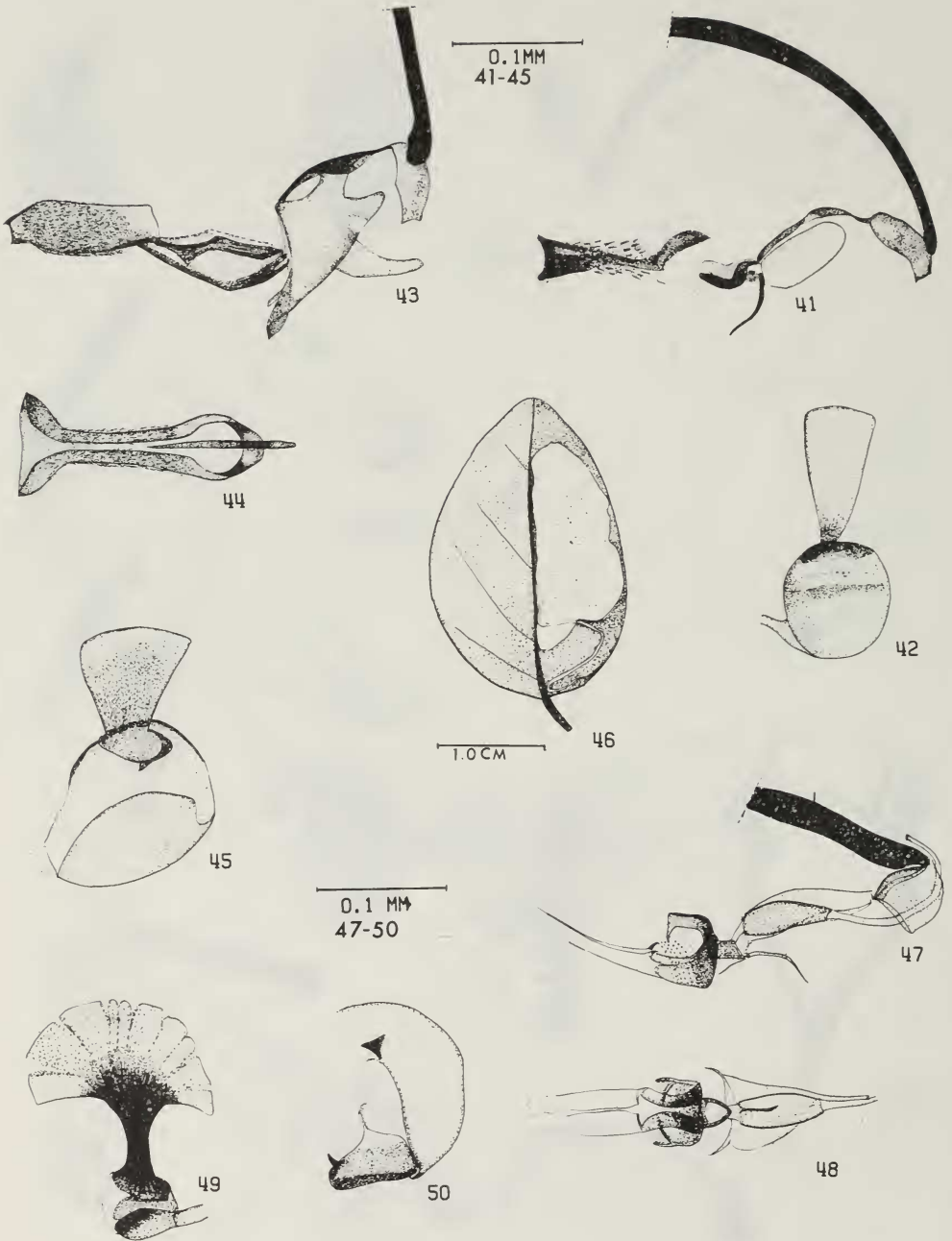


Fig. 41-42. *Amauromyza riparia*. 41. aedeagus, lateral view. 42. ejaculatory apodeme. Fig. 43-46. *A. shepherdiae*. 43. aedeagus, lateral view. 44. distiphallus, ventral view. 45. ejaculatory apodeme. 46. leaf mine on *Shepherdia canadensis* (L.) Nutt. Fig. 47-50. *Liriomyza balcanicoides*. 47. aedeagus, lateral view. 48. aedeagus, ventral view. 49. ejaculatory apodeme. 50. surstylus.

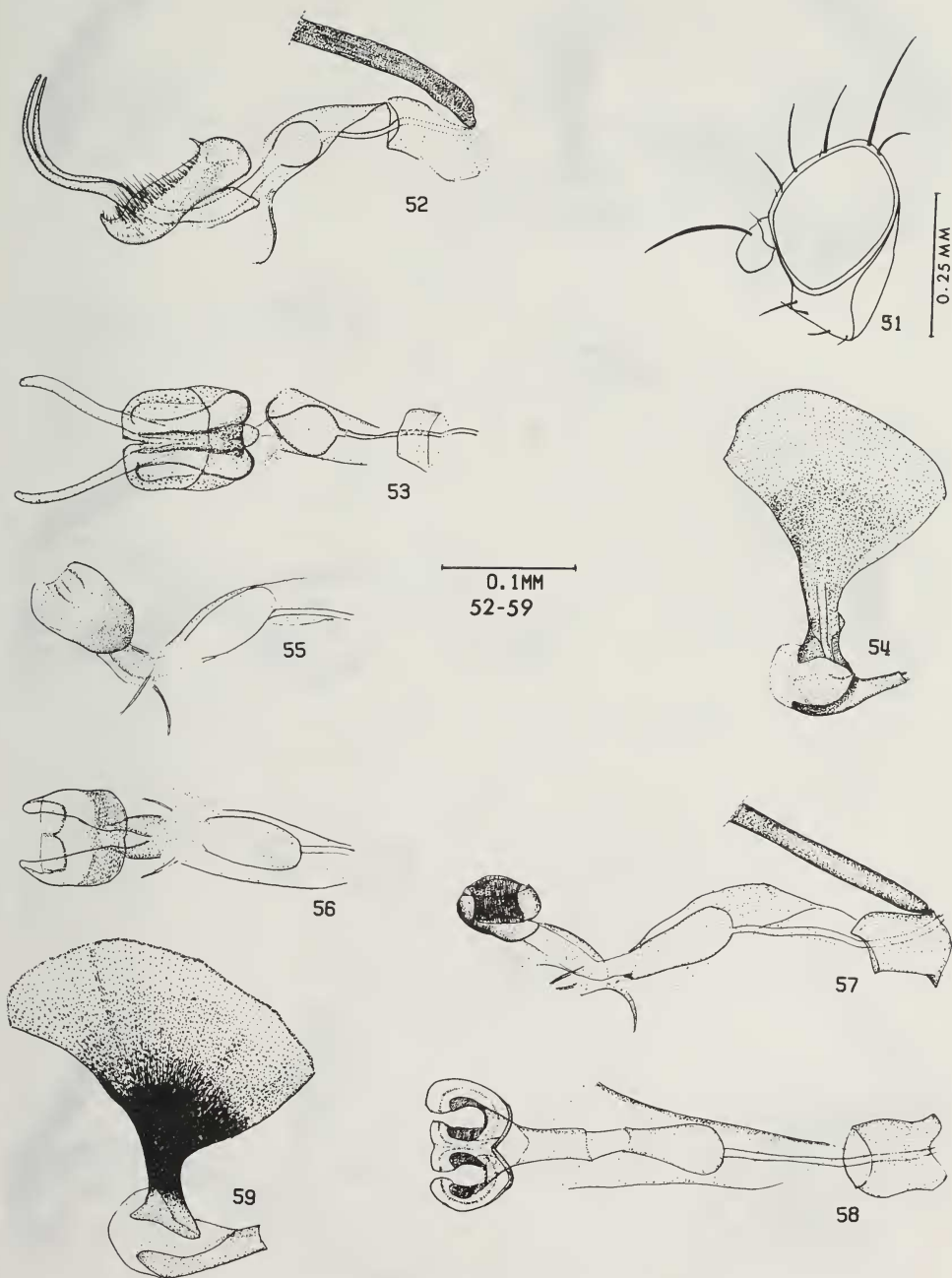


Fig. 51-54. *Liriomyza bifurcata*. 51. head, lateral view. 52. aedeagus, lateral view. 53. aedeagus, ventral view. 54. ejaculatory apodeme. Fig. 55-56. *L. eupatorii*. 55. aedeagus, lateral view. 56. aedeagus, ventral view. Fig. 57-59. *L. lathyri*. 57. aedeagus, lateral view. 58. aedeagus, ventral view. 59. ejaculatory apodeme.

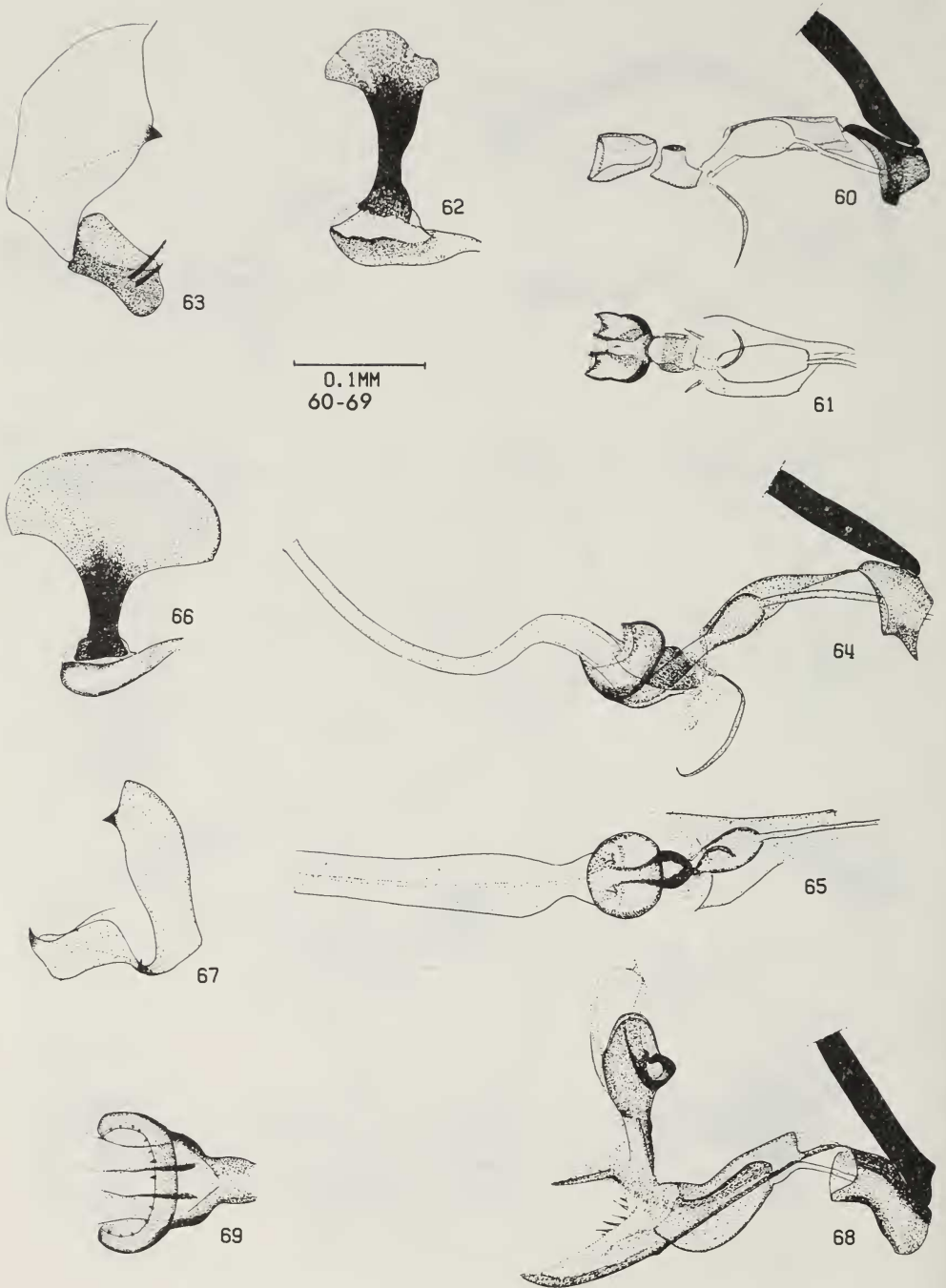


Fig. 60-63. *Liriomyza senecionivora*. 60. aedeagus, lateral view. 61. aedeagus, ventral view. 62. ejaculatory apodeme. 63. surstylus. Fig. 64-67. *L. sinuata*. 64. aedeagus, lateral view. 65. aedeagus, ventral view. 66. ejaculatory apodeme. 67. surstylus. Fig. 68-69. *L. sylvatica*. 68. aedeagus, lateral view. 69. aedeagus, ventral view.

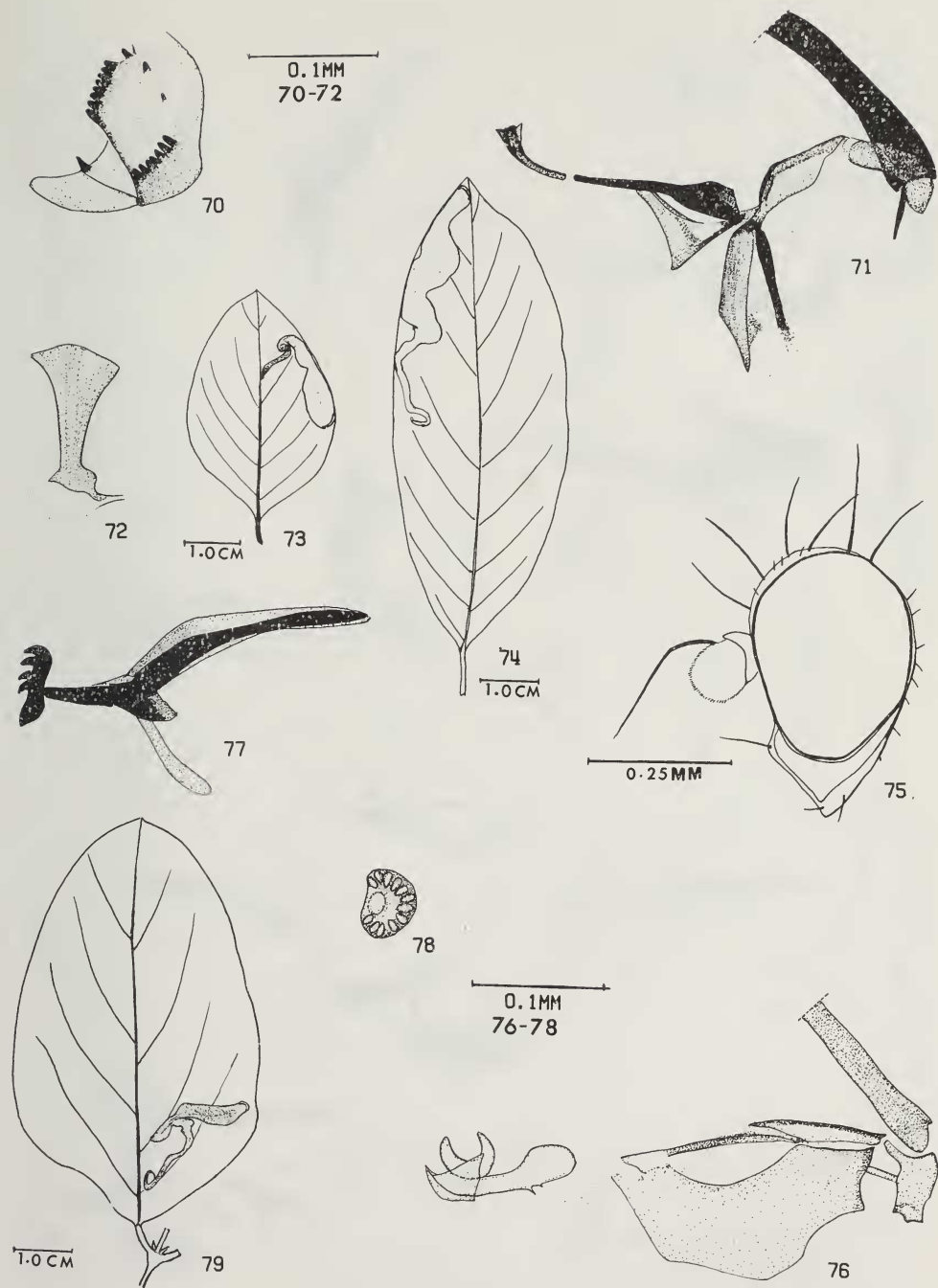


Fig. 70-72. *Metopomyza griffithsi*. 70. surstylus. 71. aedeagus, lateral view. 72. ejaculatory apodeme. Fig. 73. *Paraphytomyza orbitalis*, leaf mine on *Lonicera dioica* L. Fig. 74. *P. plagiata*, leaf mine on *Lonicera involucrata* (Richards) Banks. Fig. 75-79. *P. spenceri*. 75. head, lateral view. 76. aedeagus, lateral view. 77. cephalopharyngeal skeleton of larva. 78. posterior spiracle. 79. leaf mine on *Lonicera dioica* L.

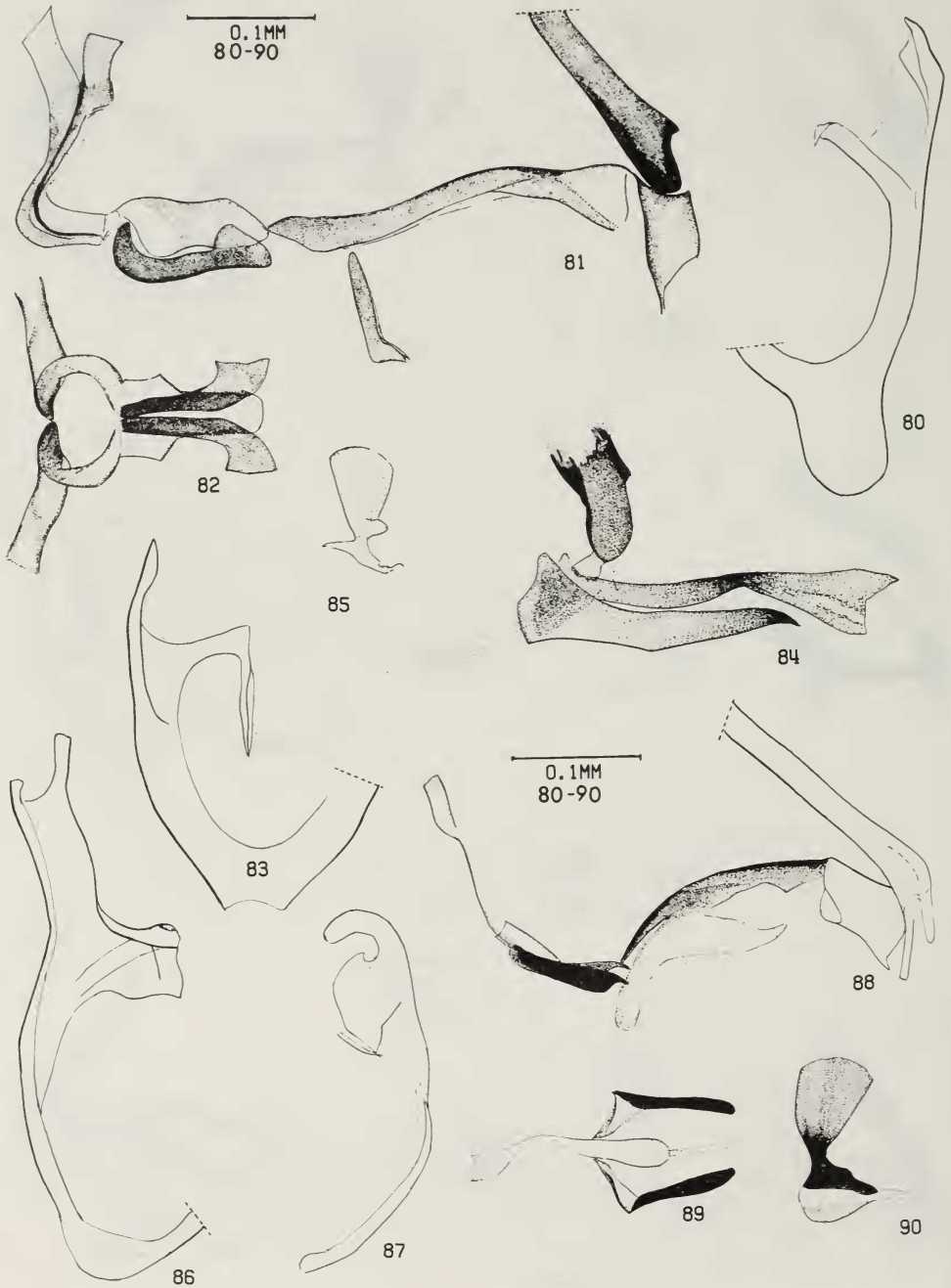


Fig. 80-82. *Phytomyza aquilegioides*. 80. hypandrium. 81. aedeagus, lateral view. 82. distiphallus, ventral view. Fig. 83-85. *P. arnicivora*. 83. hypandrium. 84. aedeagus, lateral view. 85. ejaculatory apodeme. Fig. 86-90. *P. blairmorensis*. 86. hypandrium. 87. postgonite. 88. aedeagus, lateral view. 89. aedeagus, ventral view. 90. ejaculatory apodeme.

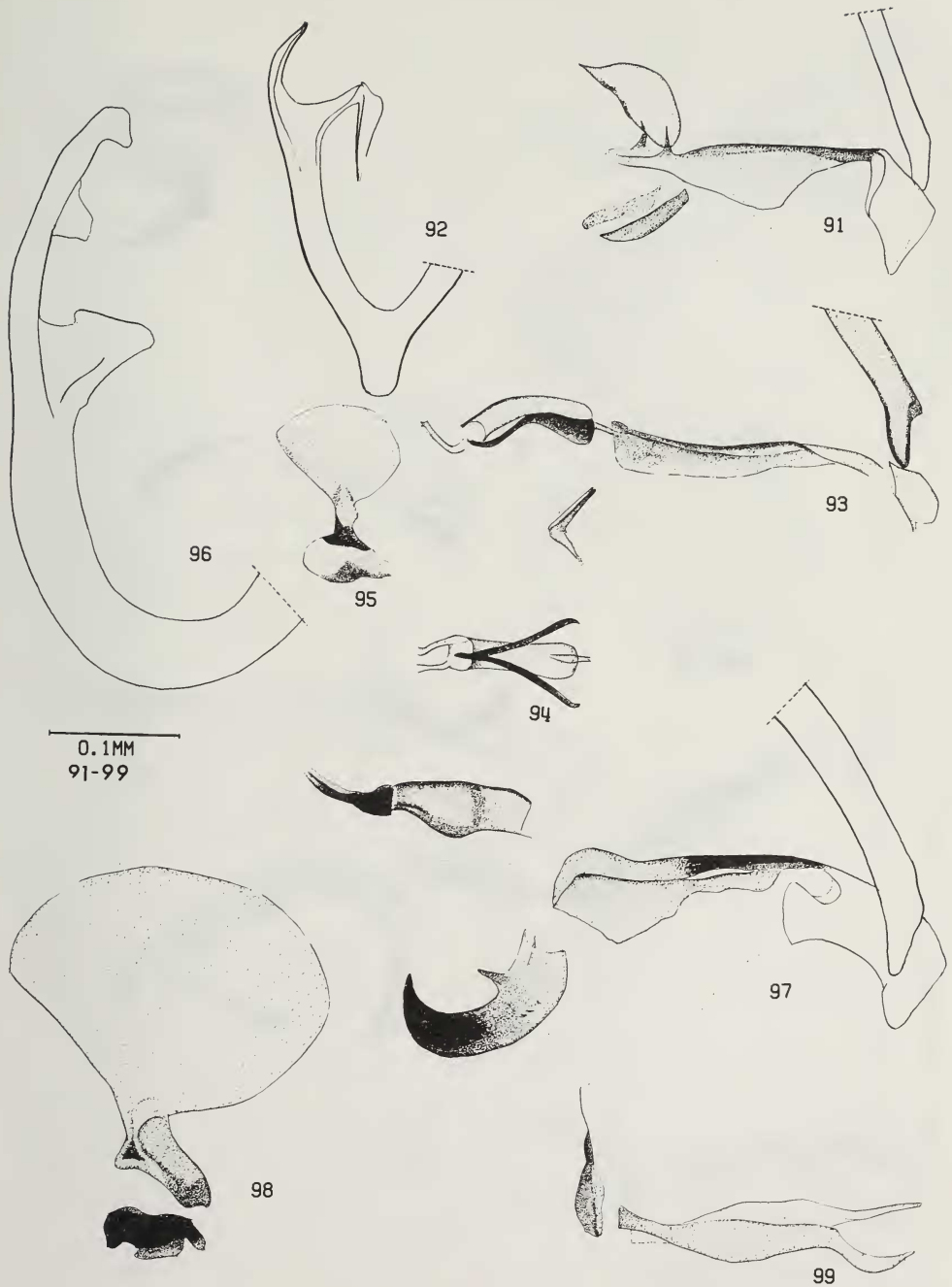


Fig. 91. *Phytomyza colemanensis*, aedeagus, lateral view. Fig. 92-95. *P. columbinae*. 92. hypandrium. 93. aedeagus, lateral view. 94. distiphallus, ventral view. 95. ejaculatory apodeme. Fig. 96-98. *P. edmontonensis*. 96. hypandrium. 97. aedeagus, lateral view. 98. ejaculatory apodeme. Fig. 99. *P. gregaria*, aedeagus, lateral view.

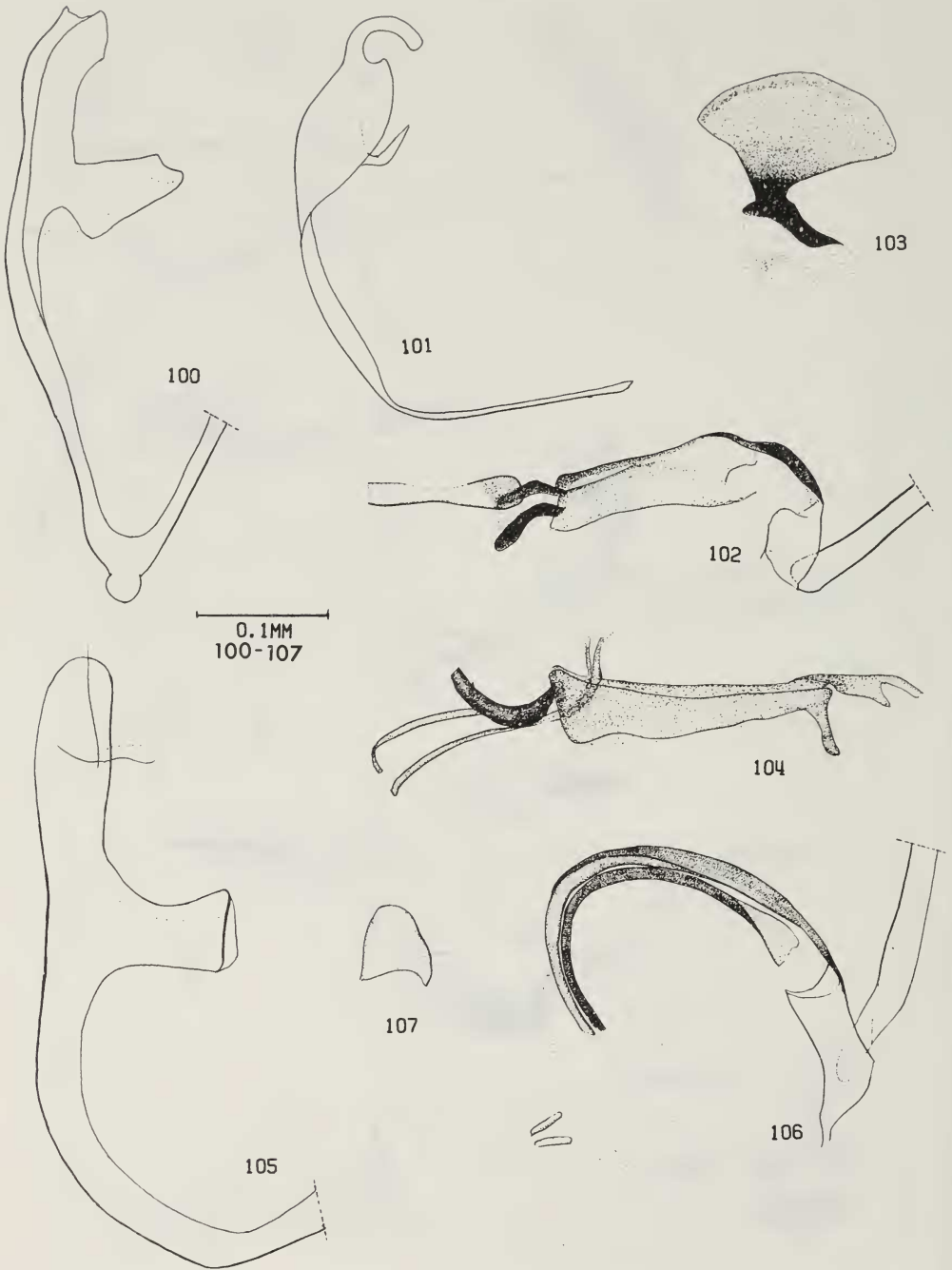


Fig. 100-103. *Phytomyza jasperensis*. 100. hypandrium. 101. postgonite. 102. aedeagus, lateral view. 103. aedeagus, ventral view. Fig. 104. *P. lactuca*, aedeagus, lateral view. Fig. 105-107. *P. luteiceps*. 105. hypandrium. 106. aedeagus, lateral view. 107. ejaculatory apodeme.

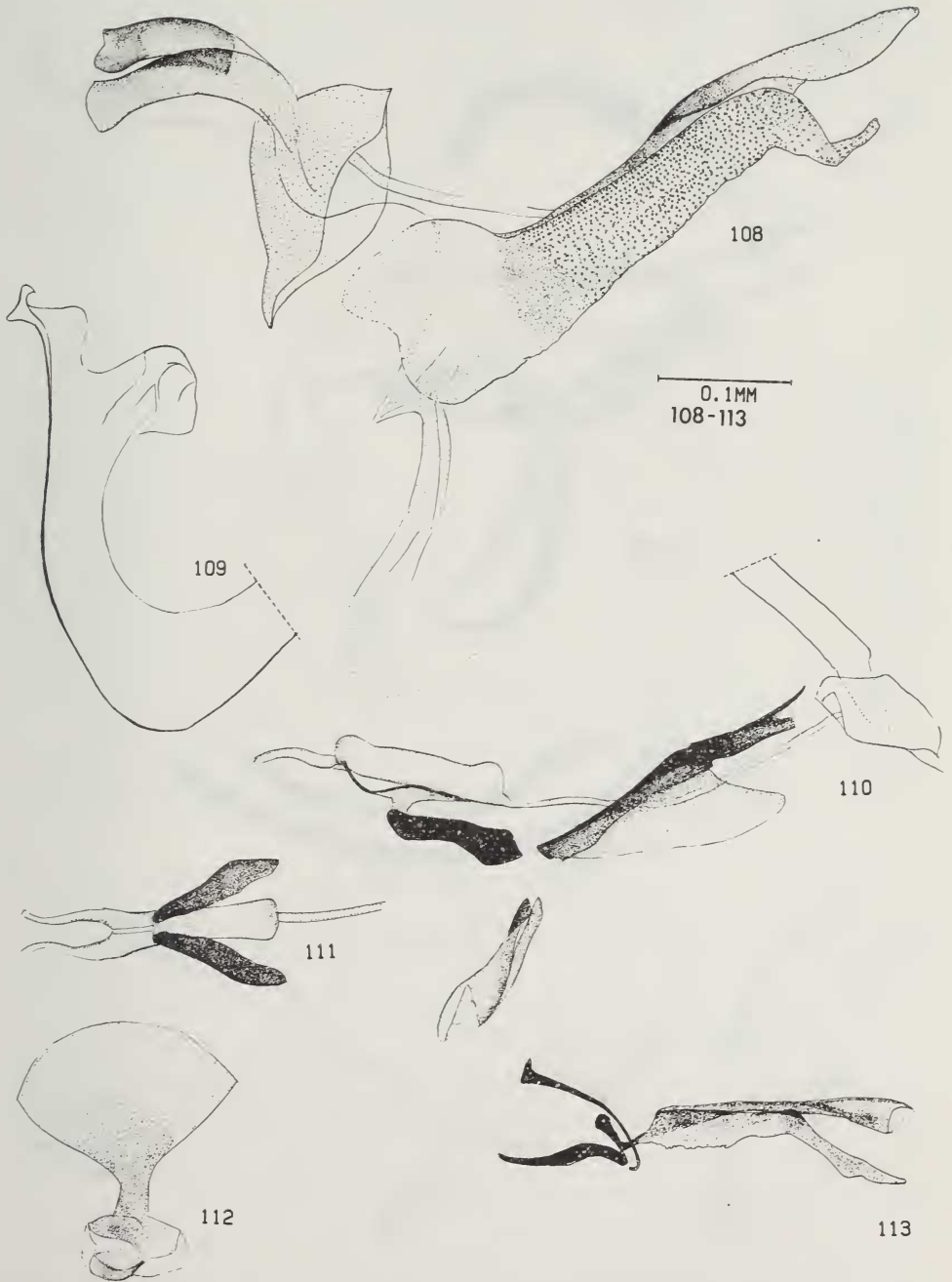


Fig. 108. *Phytomyza major*, aedeagus, lateral view. Fig. 109-112. *P. mertensiae*. 109. hypandrium. 110. aedeagus, lateral view. 111. distiphallus, ventral view. 112. ejaculatory apodeme. Fig. 113. *P. milii*, aedeagus, lateral view.

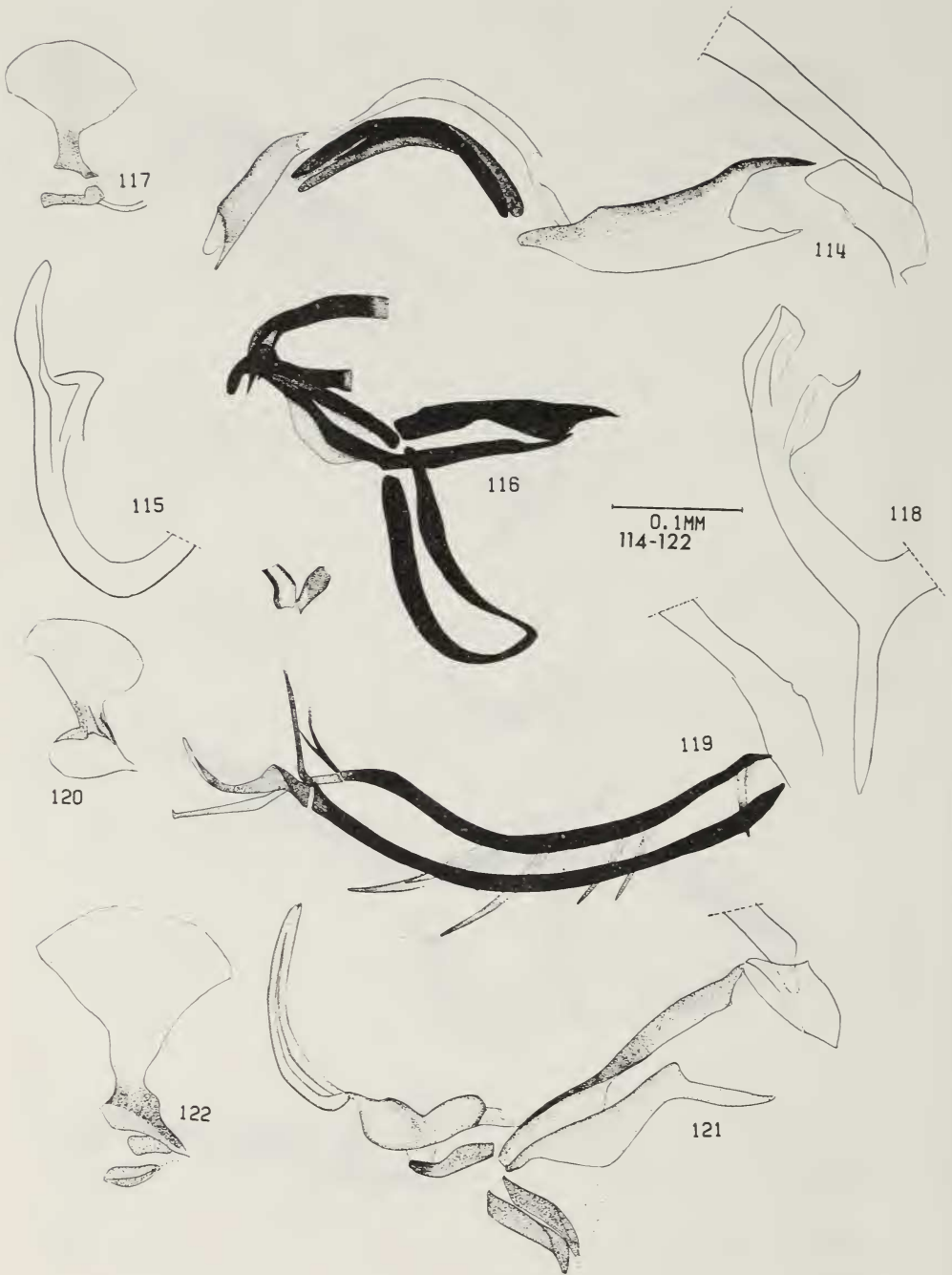


Fig. 114. *Phytomyza misella*, aedeagus, lateral view. Fig. 115-117. *P. multifidae*. 115. hypandrium. 116. aedeagus, lateral view. 117. ejaculatory apodeme. Fig. 118-120. *P. oxytropidis*. 118. hypandrium. 119. aedeagus, lateral view. 120. ejaculatory apodeme. Fig. 121-122. *P. riparia*. 121. aedeagus, lateral view. 122. ejaculatory apodeme.

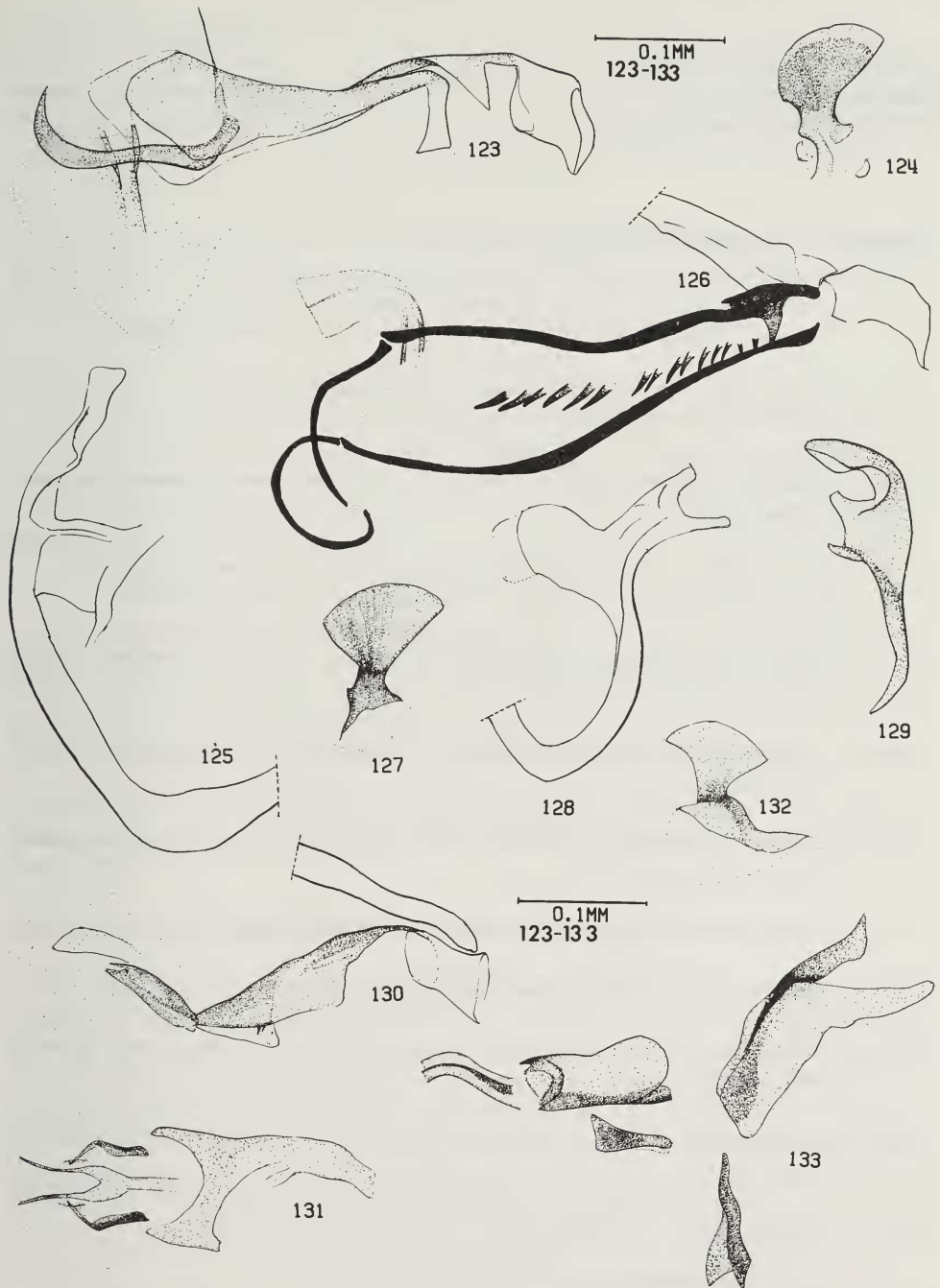


Fig. 123-124. *Phytomyza senecionella*. 123. aedeagus, lateral view. 124. ejaculatory apodeme. Fig. 125-127. *P. solidaginophaga*. 125. hypandrium. 126. aedeagus, lateral view. 127. ejaculatory apodeme. Fig. 128-132. *P. subalpina*. 128. hypandrium. 129. postgonite. 130. aedeagus, lateral view. 131. aedeagus, ventral view. 132. ejaculatory apodeme. Fig. 133. *P. timida*, aedeagus, lateral view.